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BABESIASIS (PIROPLASMOSIS) AND ANAPLASMOSIS.

(228) STOCKMAN (S.) & WRAGG (W. G.). **Cross Immunisation with *Piroplasma bigeminum* and *Piroplasma divergens*.—*Jl. Comp. Path. and Therap.* 1914. June. Vol. 27. No. 2. pp. 151-155.**

This paper contains additional proof of the non-identity of *P. divergens* and *P. bigeminum*, in the form of cross-immunity tests.

In the first experiment detailed in the paper two heifers were used. One of these had been experimentally infected with the South African strain of red-water (*P. bigeminum*) a year previously and the other had never been exposed to infection. Both animals reacted to *P. divergens* to about the same degree, and in the blood of each parasites of the *divergens* type were found from the 3rd to the 6th and 7th days respectively.

The second experiment was carried out with an animal which had passed through a reaction due to *P. bigeminum* (African strain) and six months later had resisted a second inoculation with the same strain. After a further period of six months the animal was inoculated with blood containing *P. divergens*. A slight reaction followed, unaccompanied by any rise of temperature. Parasites of the *divergens* type were found in the blood on the 15th day, and had probably been present earlier, but had not been discovered on account of their small numbers. The absence of a rise of temperature is not significant, as the authors stated in their original communication regarding *P. divergens* that very few animals show a marked reaction to the parasite.

Experiment III. In this experiment an animal which had been infected experimentally with *P. bigeminum* two years previously became infected when inoculated with blood containing *P. divergens*.

In Experiment IV the inoculations were reversed. The animal was first inoculated with *P. divergens*, and seven weeks later with *P. bigeminum*. The experiments were successful in both instances, and the two parasites made their appearance in the blood.

In Experiment V the conditions of experiment IV were repeated and the result obtained was the same. The animal was first successfully inoculated with *P. divergens*, and after a period of seven weeks was infected with *P. bigeminum*.

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Experiment VI. A heifer was inoculated with blood from an animal suffering from a naturally acquired infection with *P. divergens*. A positive reaction followed. Subsequently this animal was twice inoculated with blood from an animal that had been infected with *P. bigeminum*. No reaction occurred. The blood of this animal had, however, been giving irregular reactions with other animals. The heifer was later inoculated with the same *P. bigeminum* strain obtained from another animal, with the result that it became infected.

From this it would appear that the blood which twice failed to infect the susceptible heifer was only intermittently virulent, as it neither infected the heifer nor immunised it against a further inoculation with blood containing the same strain of parasite.

In none of the experiments recorded did either piroplasm immunise animals against the other.

(229) Chambers (F.) & Smith (J.). **Immunisation of Imported Cattle against Northern Rhodesian Piroplasmosis and Anaplasmosis.**—*Jl. Comp. Path. and Therap.* 1914. June. Vol. 27. No. 2. pp. 155-171. With 2 text-figs. and 6 tables.

The inoculations detailed in this article were carried out at the Maramba inoculation and quarantine station, Victoria Falls. The station was erected for the purpose owing to the fact that very large percentages of previous consignments of imported animals had succumbed to piroplasmosis and anaplasmosis. The station was provided with a dipping tank and every effort was made to render the enclosed land free from ticks. Very few ticks were found on the animals during the second month after their arrival and the further infestation of the station was stopped by dipping.

As it had been found by Bevan that the Rhodesian anaplasmoses were more virulent than those occurring in Cape Colony, it was decided to immunise the animals by inoculating them first with blood obtained from Pretoria and then with blood derived from local sources.

The first batch of animals was given the second inoculation after an interval of five days only, with the result that the attacks of anaplasmosis due to the two viruses were in part contemporaneous and thus a dangerous state of affairs was produced, as there is at present no drug known which is of any value for the treatment of anaplasmosis. In the second batch of animals the period elapsing between the two inoculations was nine days, and in these animals two distinct anaplasmosis reactions were obtained.

It was found that the younger and poorer cattle were the best subjects for immunisation, the most suitable age being 10 to 15 months.

The most satisfactory method of immunising imported animals against local piroplasmosis and anaplasmosis is to inject subcutaneously 10 cc. of citrated blood containing *Babesia bigeminum* and *Anaplasma centrale*, followed fourteen days later by an injection of 4 to 6 cc. of blood, derived from local sources, containing *Babesia bigeminum* and *Anaplasma marginale*.

(230) LIGNIÈRES (J.). **L'Anaplasmose bovine en Argentine.** [Bovine Anaplasmosis in the Argentine.]—*Centralbl. f. Bakt.* 1. Abt. Orig. 1914. May 27. Vol. 74. No. 1/2. pp. 133-162. With 5 text figs.

1. Anaplasmosis is endemic in certain parts of the north of the Argentine Republic, whence it may be accidentally carried to other areas by infected bovines, which form a veritable reservoir of the virus.

2. *Anaplasma argentinum* is of the same type as *Anaplasma marginale* of THEILER, but a comparative study of the two parasites is necessary before any conclusion regarding their identity or duality can be definitely arrived at.

3. In natural circumstances anaplasmosis does not occur as a pure infection; it is complicated by piroplasmoses—*P. bigeminum* and *P. argentinum*. It appears to be transmitted by the same tick—*Margaropus microplus*. Stomoxys does not act as an intermediary.

4. In order to gain a complete knowledge of anaplasmosis the parasite must be isolated, the pure disease must be studied, and the differential characters between Anaplasma and Piroplasma must be established. It is then easier to follow the different forms that anaplasmosis may take when associated with piroplasmosis.

5. Infection with anaplasmosis is equally successful whether the inoculation be subcutaneous, intravenous, or intramuscular.

6. Anaplasma is easily discoverable in the general circulation, particularly during the final crisis, that is to say when there are clinical symptoms and elevations of temperature. The parasites stain well and uniformly like chromatin by LAVERAN'S or GIEMSA'S methods. They are practically circular, are homogeneous, and vary little in size. They are generally placed at the periphery of the corpuscles. One, two, or three may be found in a single corpuscle, and they may also be found free in the plasma. At first scarcely one per cent. of the corpuscles may contain parasites, but in the later stages 30 per cent. or more may be invaded. The alterations characteristic of acute anaemia are observed in the blood at the same time.

7. Pure anaplasmosis is characterised by one or more irregular febrile crises. The most pronounced, which terminates in death, is accompanied by severe symptoms of acute anaemia, loss of appetite, extreme weakness, rapid emaciation, pallor of the mucous membranes, acceleration of the respirations and pulse, and the faeces are hard and rusty in colour.

It is a curious fact that, in spite of the rapidity and extent of the destruction of the blood corpuscles, the urine never appears to be coloured, a fact observed by THEILER. In the Argentine jaundice is rarely observed.

At the post-mortem the first noticeable thing is the pale colour of the blood, which, however, clots. The tissues are pale and sometimes present an appearance as if the animal had been bled. A yellow discolouration of the tissues is somewhat rarely observed. The muscles retain their bright appearance, but are perhaps a little pale in colour. The spleen is enlarged to two or three times the normal size, the liver is congested, the gall-bladder is enormously distended with thick or fluid granular bile.

The kidneys appear to be normal. There may be albumin in the urine, but no haemoglobin. The lymphatic glands, the alimentary tube, and the lungs do not ordinarily show any important alterations. The heart in a proportion of cases shows a large number of petechiae upon its surface.

8. In natural cases of anaplasmosis the symptoms and lesions of piroplasmosis are observed preceding those of anaplasmosis, and in particular haemoglobinuria and the nervous symptoms.

9. In areas where the disease is endemic indigenous animals suffer from it to a slight extent only.

On the other hand, imported animals, and particularly pure-bred adult animals, die in very large numbers, to the extent that it constitutes a serious obstacle to the improvement of the breeds. When resistance is offered to the disease, the period of convalescence is long, and the disease frequently takes a chronic course.

10. Anaplasma retains its vitality in the blood of recovered animals for long periods, in some cases for more than a year.

11. The first attack of anaplasmosis confers immunity.

12. Anaplasma does not appear to pass into the blood of the foetus.

13. Animals immunised against *P. bigeminum* and *P. argentinum* remain susceptible to anaplasma and vice versa.

14. Blood that is rich in parasites retains its virulence after its temperature has been reduced to - 20° C

15. Anaplasmosis is an entity quite distinct from the piroplasmoses.

16. *A priori* no conclusion can be drawn regarding the identity or duality of anaplasmata encountered in different countries. Definite information can only be based upon a comparative study of the parasites.

17. A diagnosis of anaplasmosis can only be established by the examination of blood taken during the algid period of the disease. If inoculation is resorted to the piroplasmoses must be taken into consideration.

The most useful methods of staining for the examination of blood are Giemsa and methylene blue. In the case of *P. bigeminum* the classical twin pear-shaped parasites will be found. In the case of *P. argentinum* the parasites will be very scanty, small and round, staining especially with methylene blue, or in the form of small twin pears and slightly lanceolated.

In cases of anaplasmosis the parasites will be found, sometimes in very large numbers, at the periphery of the corpuscles, and appearing as small, rounded, homogeneous bodies with the staining reactions of chromatin.

18. Prognosis is always unfavourable. Fat, well-bred, and adult animals are the most susceptible.

19. No specific is as yet known against anaplasmosis. Trypan-blue, which is effectual against *P. bigeminum*, is somewhat dangerous in anaplasmosis.

Sanitary measures must be put into force against anaplasmosis as against piroplasmosis: destruction of ticks, separation of infected from healthy areas. Immunisation will also prove to be of great value in the campaign against the disease.

20. Whatever method of immunisation be employed against either piroplasmosis or anaplasmosis, there can be no doubt that it is preferable to use successive doses of the pure viruses rather than to use blood the value of which is not exactly known. The immunity conferred by using pure viruses is reinforced to a valuable degree by the injection of blood derived from animals naturally infected in endemic areas and containing parasites of the same type as those used for the vaccination.

(231) Mellis (M. C.). **Contribution à l'Étude du Traitement de la Piroplasmose bovine par le Trypanblau.** [The Treatment of Bovine Piroplasmosis by Means of Trypanblue.]—*Rev. Vét.* 1914. June. Vol. 39. No. 6. pp. 321-334.

Bovine piroplasmosis is responsible for very serious losses among cattle in Northern Africa. The disease makes its appearance about the beginning of the summer and is very variable in its manifestations. It is said that in some cases it terminates fatally within a few hours, while in other cases its onset is very insidious and its course very prolonged. The period of convalescence is very long "in the few animals which escape death."

The author gives details of 23 cases which have been treated with trypanblue.

The cases were treated in ordinary practice, and the diagnosis was not based upon microscopic examination of the blood, but upon the clinical features of the disease.

In 19 out of the 23 cases recovery followed, and in the four cases which terminated fatally the drug was administered subcutaneously. Subcutaneous injection of the drug renders its action slower, the effects not being observed until 24 to 36 hours later. After intravenous injection the effects are observed in 12 to 18 hours.

The author has always used pilocarpine in conjunction with the trypanblue, with the object of hastening the diffusion of the drug in the circulation and combating the constipation which is always observed in cases of bovine piroplasmosis.

None of the treated animals had relapses.

TRYPANOSOMIASIS.

(232) Yorke (W.) & Blacklock (B.). **The Differentiation of the more important Mammalian Trypanosomes.**—*Ann. Trop. Med. & Parasit.* 1914. Apr. Vol. 8. No. 1. pp. 1-12. With 1 coloured plate and 1 chart.

This paper contains a review of the methods that are in use for the identification of different species of trypanosomes. The subject is dealt with under two main headings—the trypanosome as it occurs in the vertebrate host, and the trypanosome as it occurs in the invertebrate host.

Under the first of these headings the following characters are dealt with:—Motility, morphology, pathogenicity, symptomatology, and serum diagnosis.

Under the second heading the following points are considered:—Specific host, anatomical parts of the fly infected, period of incubation of trypanosomes in Glossina, morphological characters of trypanosomes in the tsetse.

Motility. This is influenced by so many variable factors that it cannot be considered as a valuable character in the identification of species.

Morphology. This is considered under two sub-headings: qualitative characters, and quantitative characters. The former are those recognisable by simple microscopic examination, and the latter require mathematical expression for their appreciation. Under the first sub-heading the various parts of the trypanosome are discussed and their value as distinguishing features considered.

With regard to the quantitative characters, the length and breadth, particularly the maximum and minimum length of monomorphic trypanosomes, are considered to be of considerable value. The average length of polymorphic trypanosomes is of little or no value, owing to the great variation from day to day in the type of the majority of the trypanosomes present in the blood.

The breadth of trypanosomes is of importance in some instances. *T. montgomeryi* and *T. congolense* have been distinguished from each other by the difference in their breadth; *T. caprae* differs from *T. vivax* in its heavier build.

The degree of *pathogenicity* and the range of pathogenicity are no longer valuable aids in the differentiation of species, recent work having shown that these are both liable under certain conditions to considerable variation.

Symptomatology is also of little value. A symptom which appears to be characteristic of a trypanosome infection is the formation of plaques in horses infected with dourine.

The reactions given by the various methods of *serum diagnosis* are recognised as being non-specific and therefore of no value for the differentiation of species. The authors have had no experience of cross-immunity as a means of identifying trypanosomes.

Invertebrate host. It appears to be probable that all varieties of tsetse are capable of transmitting most, if not all, of the African pathogenic trypanosomes, and that therefore the identification of the fly transmitting a trypanosome in a particular instance furnishes no evidence as to the identity of the trypanosome.

The part or parts of the fly involved in the development of trypanosomes may be of considerable importance in connection with the identification of trypanosomes. Upon these lines trypanosomes may be classified in three groups: (*a*) Those in which development is limited to the proboscis, (*b*) those in which the process commences in the gut and extends forwards to the proboscis, and (*c*) those in which it commences in the gut and is completed in the salivary glands.

The period of incubation in the fly is dependent upon the temperature and is therefore of no diagnostic value.

Sufficient is not yet known regarding the development of trypanosomes in flies to allow of the morphological changes presented by the parasites in the flies being of any value for the purposes of identification.

Group	Sub-Group		Trypansome	Date and designators	Synonyms	Motility	Morpholoc		
							Qualitative Characters		
							Flagellum	Blepharoplast	Nucleus
I	A	1	*T. brucei*	1899 Plimmer & Bradford	....	....	Always free	....	....
		2	*T. evansi*	1885 Steel	*T. soudanense* (1907) *T. venezuelense* (1910)	....	,,	....	....
		3	*T. hippicum*	1910 Darling	....	....	,,	....	....
	B	4	*T. equiperdum*	1901 Doflein	....	....	,,	....	....
	C	5	*T. equinum*	1901 Voges	....	....	,,	Absent	....
	D	6	*T. vivax*	1905 Ziemann	*T. cazalboui* (1906)	Very rapid, translatory	,,	....	....
		7	*T. caprae*	1910 Kleine	....	,, ,,	,,	....	....
		8	*T. uniforme*	1911 Bruce	....	....	,,	....	....
	E	9	*T. transvaaliense*	1903 Laveran	....	....	,,	Near nucleus	....
		10	*T. theileri*	1902 Laveran	....	....	,,	....	....
	F	11	*T. ingens*	1909 Bruce	....	....	,,	Near nucleus	....
		12	*T. tragelaphi*	1913 Kinghorn & Yorke	....	....	,,	Near nucleus	....
	G	13	*T. lewisi*	1881 Kent	....	Very rapid, translatory	,,	Rod shaped, transverse	Junction of a and middle thi
	H	14	*T. cruzi*	1909 Chagas	....	Tumbling movement	,,	Large ovoid	....
II		15	*T. congolense*	1904 Broden	*T. dimorphon* (1904) *T. pecorum* (1910) *T. confusum* (1909)	....	Never free	....	....
		16	*T. nanum*	1905 Laveran	....	....	,,	....	....
	J	17	*T. montgomeryi*	1909 Laveran	....	....	,,	....	....
	K	18	*T. simiae*	1912 Bruce	*T. ignotum* (1912)	....	,,	Frequently projects as lateral excrescence	....
III	L	19	*T. gambiense*	1902 Dutton	....	....	Sometimes free and sometimes not	....	....
		20	*T. multiforme*	1912 Kinghorn & Yorke	....	....	,,	....	....
		21	*T. nigeriense*	1913 Macfie	....	....	,,	....	....
		22	*T. pecaudi*	1907 Laveran	....	....	,,	....	Posterior nucleu forms
	M	23	*T. rhodesiense*	1910 Stephens & Fantham	....	....	,,	....	,,
		24	*T. ugandae*	1913 Stephens & Blacklock	*T. brucei* (Uganda) (1909)	....	,,	....	,,
		25	*T. equi*	1913 Blacklock & Yorke	....	....	,,	....	,

...S OF THE MORE IMPORTANT MAMMALIAN TRYPANOSOMES

Morphology				Pathogenicity	Development in insect host when known	Where first found	Remarks
...haracters		Quantitative Characters					
Nucleus	Cytoplasm	Length in microns	Breadth in microns				
		Min. Max.	Min. Max.				
....	....	18 34	..	Acute for all laboratory animals	Unknown	Zululand	
....	....	18 34	1·5 2	,, ,, ,,	,,	India	
....	....	18 28	1·5 3	,, ,, ,,	,,	Central America	
....	....	16 35	..	,, ,, ,,	Transmitted by coitus	North Africa	Causes characteristic 'plaques'
....	....	Average 23	1·5	,, ,, ,,	Unknown	South America	
....	Club-shaped	16 31	2 3	Equidae and ruminants only	Limited to the proboscis in glossina	Cameroon	
....	Heavier build than *vivax*	18 32	1·75 4·25	,, ,,	,, ,, ,,	German East Africa	
....	....	12 19	1·5 2·5	,, ,,	,, ,, ,,	Uganda	
....	....	18 50	4 6	Slight to bovidae only	Unknown	Transvaal	
....	....	25 70	2 5	,, ,,	Possibly hippobosca, details unknown	Transvaal	
....	*Myonemes*	72 122	7 10	Unknown	Unknown	Uganda	
....	,,	52 72	5 8·5	,,	,,	N.E. Rhodesia	
Junction of ant. and middle thirds	....	Average 24	..	Rats only infected	Intestines of rat fleas and lice	(World wide)	
....	....	Average 20	..	Slight for laboratory animals	....	Brazil	Dividing forms not seen in blood?
....	....	8 19	Average 1·5	Acute for all laboratory animals	Gut and proboscis of glossina	Congo	Probably these trypanosomes are identical
....	....	10 16	Average 1·5	Equidae and ruminants only?	,, ,,	Soudan	
....	Heavier build than *congolense*	10 20	Average 3·3	Slight for laboratory animals	Unknown	N.E. Rhodesia	
....	....	12 23	..	Acute for monkeys and pigs only	Proboscis of *Glossina morsitans*	Nyasaland	
....	....	13 39	..	Acute for laboratory animals	Gut and salivary glands of glossina	Gambia	
....	....	10 33	..	Slight for laboratory animals	Unknown	N.E. Rhodesia	
....	....	8 37	..	,, ,,	,,	Nigeria	
Posterior nuclear forms	....	14 35	..	Acute for laboratory animals	Gut and proboscis of glossina *	Senegal	* Roubaud & Bouet's observation
,,	....	12 39	..	,, ,,	Gut and salivary glands of glossina	N.E. Rhodesia	
,,	....	13 38	..	,, ,,	,, ,, ,,	Uganda	
,	....	14 36	..	,, ,,	Transmitted by coitus	North Africa	

(233) Bruce (D.), Hamerton (A. E.), Watson (D. P.) & Lady Bruce. **Description of a Strain of *Trypanosoma brucei* from Zululand. Part I.—Morphology.**—*Proc. Roy. Soc.* 1914. June 4. Vol. 87. No. B. 598. pp. 493-510. With 3 plates.

"The object of this paper is to describe as fully as possible the morphology of this new strain of *T. brucei* from Zululand, in order to try to prove its identity with the trypanosome causing disease in man in Northern and Southern Rhodesia, Nyasaland, and German and Portuguese East Africa."

The strain described is one obtained from Shilston, Pietermaritzburg, who isolated it from an infected mule at Somkele, in Zululand.

Referring to what is called the 1896 strain of *T. brucei*, the authors quote passages in the original descriptions of this parasite by Bruce, by Kanthack, Durham, and Blandford, and also by Plimmer and Bradford, indicating that the parasite was dimorphic.

A comparison is instituted between a biometric chart drawn up by Shilston based upon the measurements of 400 trypanosomes of the 1913 strain and one constructed upon the measurements of 200 individuals contained in preparations made in 1896. These charts bear a remarkable resemblance to each other, but, as pointed out by the authors, too much importance must not be attached to this resemblance, as the measurements upon which they are based were not made under exactly comparable conditions. Comparison between the pathogenicity of the two trypanosomes for the horse and dog also reveals a close resemblance.

Morphology of the 1913 *strain.*

A table gives the measurements in microns of 1,000 trypanosomes from the monkey, dog, rat and guinea-pig, and a second table (reproduced) gives the average lengths of the parasite in these species:—

Species of animal.	Number of Trypanosomes measured.	Average length.	Maximum length.	Minimum length.
Monkey	160	21·2	31·0	12·0
Dog	260	21·5	32·0	16·0
Guinea-pig	30(?80)	22·9	35·0	17·0
Rat	500	20·8	28·0	17·0

A chart constructed upon the measurements given by the 1,000 trypanosomes of the 1913 strain resembles some of the charts constructed upon the Nyasaland human strain, but differs from others.

A further series of charts is constructed upon the measurements of 500 individuals taken on nine consecutive days in the blood of rats. Some of these charts record the measurements after the passage of the trypanosome through *G. morsitans*, once, twice and three times. The differences between these charts are very slight. Curves are given comparing the 1913 strain of *brucei* and the Nyasaland wild game strain and a certain degree of resemblance is observed.

Conclusions :—

"1. The trypanosome described in this paper under the name of the "Zululand strain, 1913," is the same species as that discovered by Bruce in Zululand in 1894; reported on by Kanthack, Durham and Blandford in 1898; and named *T. brucei* by Plimmer and Bradford in 1899.

"2. As regards its morphology, this trypanosome is absolutely identical with the trypanosome causing disease in man in Nyasaland, the *T. rhodesiense* of Stephens and Fantham."

Part II.—Susceptibility of Animals.—*Idem.* pp. 511-516.

The Commission had no opportunity of studying the effect produced by the "1913 strain" on the horse, but SHILSTON found that it proved fatal in 35 days. In BRUCE'S "Further Report on Nagana, in Zululand, 1896," it was recorded that two horses were killed by the "1896 strain" in 30 and 49 days respectively.

Two out of six oxen inoculated became infected. One died in 310 days, and the other apparently made a complete recovery. Four out of seven goats became infected and died. The average duration of the disease was 77·2 days. There was no oedema of the face or corneal opacity observed.

Sheep could not be procured for experiment.

Eight monkeys died in from 8 to 65 days (average 29·2).

Seventeen dogs died in from 12–26 days (average 18·5). In eight of these there was opacity of the cornea, and in two swelling of the limbs.

Eight experiments with rabbits are recorded, but six of these were reported by SHILSTON. The average duration of the disease was 32·7 days.

Ten guinea-pigs were inoculated. All became infected and died, but four of them were inoculated more than once before infection was set up. The disease lasted from 15 to 89 days (average 43·7).

Twenty-three rats were inoculated and all died, the average duration of life being 27 days.

These results are compared in tabular form with the results obtained with the strain causing disease in man in Nyasaland. The following tables are slightly abbreviated :—

Zululand strain, 1913.

	Horse.	Ox.	Goat.	Monkey.	Dog.	Rabbit.	Guinea-pig.	White rat.
Average duration in days	38	310	77	29	18	33	44	27
Animals used	3	1	7	8	17	8	10	23

Human strain, Nyasaland.

	Horse.	Ox.	Goat & Sheep	Monkey.	Dog.	Rabbit.	Guinea-pig.	White rat.
Average duration in days	0	134	42	26	34	28	67	30
Animals used	0	1	29	20	25	7	15	21

RECOVERIES.

Zululand strain, 1913.

	Horse.	Ox.	Goat.	Monkey.	Dog.	Rabbit.	Guinea-pig.	White rat.
Percentages	0	83	0	0	0	0	0	0
Animals used	3	6	4	8	17	8	10	23

Human strain, Nyasaland.

	Horse.	Ox.	Goat & Sheep	Monkey.	Dog.	Rabbit.	Guinea-pig.	White rat.
Percentages	0	80	0	0	0	0	0	0
Animals used	0	5	29	20	25	7	15	21

Conclusion :—

"The pathogenic action of *T. brucei*, Zululand strain, 1913, on various animals is so similar, not only in regard to the symptoms during life but also in the *post-mortem* appearances and rate of mortality, to that of the trypanosome causing disease in man in Nyasaland, that it affords another proof that these two trypanosomes are identical."

Part III.—Development in *Glossina morsitans.—Idem.* pp. 526-531. With 1 plate.

Seven experiments were made with laboratory-bred flies. Three of these were positive and four negative. Two experiments made with wild flies both had positive results.

Three hundred and eight laboratory-bred flies were used and 15·3 per cent. were found to be infected. In some cases the number of infected flies in a batch was found to be very small (1 in 58), and in others it was very high (20 in 45).

Of 100 wild flies used in the two positive experiments only 21 were dissected, and of these 5 were found to be infected.

The average period elapsing before the fly becomes infective appears to be 21 days.

Dissection of the laboratory-bred flies used in the positive experiments showed that in two the labial cavity and the hypopharynx contained trypanosomes, and that in one of these and in five others the salivary glands were infected.

None of the laboratory-bred flies used in the negative experiments had any trypanosomes either in the proboscis or in the salivary glands.

The trypanosomes found in different stages of development in the flies agree very closely in morphology with those found in flies infected with the trypanosome causing disease of man in Nyasaland.

Conclusions.

" 1. *T. brucei*, Zululand, 1913, belongs to the same group as *T. gambiense* as regards its cycle of development in the tsetse fly.

" 2. It has been shown that the trypanosome causing disease in man in Nyasaland also belongs to the same group.

" 3. The cycle of development of the Nyasaland and Zululand trypanosomes in *G. morsitans* is so marvellously alike that it affords another reason for believing in the identity of these two trypanosomes."

(234) Oehler (R.). **Untersuchungen über den Dimorphismus von *Trypanosoma brucei*.** [**Investigations regarding the Dimorphism of *T. brucei*.**]—*Zeitschr. f. Hyg. u. Infektionskr.* 1914. Apr. 1. Vol. 77. No. 2. pp. 356-370. With 6 text-figs.

The author applied his method of inoculation with single trypanosomes to a strain of *T. brucei* brought from East Africa by Braun and Teichmann. This strain showed marked polymorphism, and posterior nuclear forms were observed among the short aflagellar trypanosomes.

Forty inoculations into mice with single trypanosomes were made and infection resulted in two instances only. The period of incubation was 6 days in both instances, as compared with 4 to 6 days after inoculation with a large number of trypanosomes.

This proportion of successes was much lower than had been obtained previously with a virulent strain of nagana obtained from Togoland. In that case the successes had numbered 20 per cent. The author ascribes this difference to a difference of virulence in the two strains.

The infections in the two infected mice were as markedly polymorphic as the original strain, and this polymorphism was recognisable from the first day of infection.

The conclusions drawn from these facts are :

1. The dimorphism of *T. brucei* is not due to a mixed infection.

2. The dimorphism of *T. brucei* has probably nothing whatever to do with the differentiation of the sexes.

An account is given of some experiments shewing that a mixed infection may be purified by passing the trypanosomes not only through different species of animals, but even through the same species.

A mixture of a salvarsan-fast strain of the Togoland nagana strain and a salvarsan-susceptible strain of the same trypanosome was inoculated from mouse to mouse in series. By adding salvarsan solution to blood from an infected mouse the two trypanosomes could be recognised in moist preparations, as the salvarsan-fast trypanosomes retained their vitality, while the salvarsan-susceptible trypanosomes rapidly became immobolised. As the number of passages became greater the number of salvarsan-fast trypanosomes decreased, and after about 40 passages they could not be detected in the manner described. The disappearance as judged by this method was not complete, as could be proved by treating a mouse inoculated with such a strain with salvarsan in a dose of 1·0 mgm. This sufficed to kill off the susceptible trypanosomes, but the salvarsan-fast trypanosomes remained and reappeared in the blood.

In the case of antimony tartrate-fast strains the purification of a mixture occurs in the same way, but at a greater rate. The purification of mixture of the type described, and probably of other types also, is due to the difference in the rapidity of multiplication.

Regarding the significance of dimorphism, the author is of the opinion that the changes in shape of the trypanosomes are, so to speak, the anatomical expression of the remittent nature of the disease. He believes that the slender forms herald a multiplication of the trypanosomes and the short, broad forms a remission.

(235) Oehler (R.). **Der Dimorphismus des *Trypanosoma brucei* bei experimenteller Behandlung. [The Dimorphism of *Trypanosoma brucei* in Experimental Treatment.]**—*Zeitschr. f. Hyg. u. Infektionskr.* 1914. June 24. Vol. 78. No. 1. pp. 188-192.

The author produces evidence regarding the connection between the dimorphism of the trypanosome and the remittent nature of the infection.

Mice can be incubated at 35°C. without ill-effect provided they are given water to drink, and infection with trypanosomes does not cause the temperature to rise to a height that proves fatal (38·5°) even in mice kept in an incubator at 35°C.

Mice of the first ten passages suffered from a chronic infection, death taking place in from 20 to 70 days. And the course of the infection was marked by numerous remissions, during which the trypanosomes entirely disappeared from the blood. Broad forms present in the blood increased to a marked extent at the remissions. If such a mouse be placed in an incubator when trypanosomes are more or less numerously present in the blood, a remission with predominating broad forms will be produced in all probability in two or three days.

In mice of the 6th to 10th passage kept at room temperature the disease became acute, but in mice of the same passages kept in the incubator the disease remained chronic, relapses occurred, and dimorphism was marked.

A very similar result was observed with mice of the 20th to 30th passages.

Remissions produced by drugs also coincided with an increase in the proportion of broad forms present, but the proportion was not very high.

Inoculation with the spirillum of recurrent fever on the day following inoculation with the trypanosome also lead to a remission coincident with the increase in the number of spirilla, but in this case no broad forms were discovered.

(236) Bruce (D.), Hamerton (A. E.), Watson (D. P.) & Lady Bruce. **The Trypanosome causing Disease in Man in Nyasaland. Part III. Development in *Glossina morsitans*.**—*Proc. Roy. Soc.* 1914. June 4. Vol. 87. No. B. 598. pp. 516-525. With 1 coloured plate.

The investigation of the development of this trypanosome in the fly was rendered difficult by the fact that it was impossible to find the pupae of the fly in any large numbers. The laboratory-bred flies had therefore to be hatched out of pupae obtained from captive flies. A further difficulty was that flies so hatched are not so strong and healthy as flies hatched out from wild pupae.

Eleven experiments were carried out with laboratory-bred flies. Three were positive and eight negative.

Five experiments were carried out with wild flies and all were positive.

Although only three of the eleven experiments carried out with laboratory-bred flies were positive, infected flies were found in eight of the experiments; the total number of infected flies (found by dissection) was 25 and the total number of flies used was 287. The percentage of infected flies was therefore 8·7. The period elapsing before infected flies became infective varied in the three positive cases from 14 to 31 days. This period was arrived at by subtracting seven days from the period elapsing between the first infected feed and the appearance of trypanosomes in the blood of the experimental animal, seven days representing the period of incubation in the experimental animal.

Attention is drawn especially to the fact that the period elapsing before the flies became infected was very short in one instance—14 days.

Two of the positive results obtained in the five experiments carried out with wild flies were evidently due to the presence of naturally infected flies, as the periods elapsing before the flies became infected were only one and three days. In the other three experiments the periods were 18, 25 and 30 days. In all, 255 flies were used, and of these 9 per cent. were found to be infected.

All flies dying during the course of the experiments were dissected. In the three positive experiments with laboratory-bred flies nine infected flies were found. In none of these were any trypanosomes found in the proboscis, labial cavity, or hypopharynx. In one or other of the flies the proventriculus, fore-, mid- and hind-gut, and salivary glands were found to contain trypanosomes, and in one of them all these parts were found to contain them.

Dissection of the flies used in the positive experiments with wild flies shewed a similar condition of affairs, but there was infection of the proboscis with trypanosomes in five cases. It is pointed out, however, that with trypanosomes numerously present in the salivary glands it would be natural to expect to find some in the proboscis, this term including the hypopharynx. It is further pointed out that in some of the wild flies the infections of the proboscis were due to *T. pecorum*, *T. simiae*, or *T. caprae*.

One of the laboratory-bred flies used in the experiments which gave negative results was found to have trypanosomes in its salivary glands, and no explanation of the failure of this fly to infect can be given. The remainder had trypanosomes in neither the proboscis nor the salivary glands.

The development of the trypanosome in the fly is said to be exactly parallel to that of *T. gambiense* in *G. palpalis*. The fly becomes infective in 14 to 31 days after the infecting meal.

The conclusions drawn are:

"1. The trypanosome causing disease in man in Nyasaland belongs to the same group as *T. gambiense*, the development taking place in the alimentary tract and salivary glands, not in the proboscis, of the fly

"2. The percentage of flies which become *infected* is the same as in *T. gambiense*, 8 per cent.

"3. The percentage of flies which become *infective* is about 1 per cent.

"4. The length of time which elapses before a fly becomes infective varies from 14 to 31 days, average 23 days.

"5. The infective type of trypanosome in the salivary glands—corresponding to the final stage of the cycle of development—is similar to the short and stumpy form found in the blood of the vertebrate host."

(237) YORKE (W.) & BLACKLOCK (B.) **The Identity of *T. rhodesiense* with the Trypanosome of the Same Appearance found in Game.** —*Brit. Med. Jl.* 1914. June 6. pp. 1234-1236.

This paper is called forth by one published by KLEINE, in which the view generally held by German investigators, namely, that the trypanosome occurring in game in Rhodesia and that causing disease in man are not identical, is confirmed. The arguments used by KLEINE in support of his view are examined in detail.

The German investigators agree that the two trypanosomes are morphologically identical and that they cannot be distinguished on the grounds of pathogenicity or method of development in the fly, but they nevertheless believe the parasites to be different. KINGHORN and YORKE are said to have failed to have observed the presence of *T. brucei* in heavily infested *morsitans* areas, but it is pointed out that this assumes that the two parasites are distinguishable from each other.

The second argument used by KLEINE, namely, that the finding of infected animals in certain *morsitans* areas while no cases of sleeping sickness occurred is sufficient to separate the two parasites, is criticised because of the difficulty of ascertaining with absolute certainty that no case of human trypanosomiasis occurs in any particular district. The opponents agree that there can be no question of acquired immunity, but they disagree sharply regarding the possibility that human beings are generally very resistant and only occasionally susceptible, the English authors holding that such may be the case. In support of the English view mention is made of the recent work done in connection with the infection of rabbits with *T. vivax* and that concerning the identity of *T. nanum* and *T. congolense*.

TODD'S observation is referred to, in which a European and two natives were inoculated with blood from a cow suffering from trypanosomiasis of an undetermined type, and it is pointed out that this observation has no actual bearing upon the question, for the very reason that the species of trypanosome used was not determined, and that it was probably either *T. vivax* or *T. congolense*, as these are more commonly found in cattle than the polymorphic type of trypanosome. TAUTE'S experiment conducted upon himself is explicit, and whereas the German observers refer to it as supporting their view that the trypanosomes are different, the English authors consider it as affording strong support to their view that human beings are capable of offering a high degree of resistance to infection with trypanosomes.

Further support of the English view is drawn from the fact that the disease in human beings occurs sporadically in widely scattered areas, and this suggests that there must be some endemic reservoir apart from human beings.

WECK'S observations regarding the susceptibility of the antelope and the possibility of infecting monkeys from the antelope are further evidence in support of the authors' view, because "to assume that the game is infected with two different trypanosomes, alike in every respect with the single exception that one variety is fatal to man whilst the other is innocuous, would be, in our opinion, excessive theorising."

Conclusions :

"In favour, then, of game being the reservoir of human trypanosomiasis in South Central Africa we have the following facts :

"1. Human beings and game are known to be infected with trypanosomes identical as regards morphology, pathogenicity in laboratory animals, and their development in *G. morsitans*.

"2. The human trypanosome can be successfully inoculated into game.

"3. The peculiar sporadic occurrence of the disease in human beings suggests that they were infected from a widely spread reservoir of the infection (the game) rather than from one another.

"In conclusion, we submit that the hypothesis that man enjoys marked natural immunity, and is in consequence to a great extent resistant to infection with this parasite, affords a satisfactory explanation of the distribution of the disease, of its comparative rarity, and of the fact that TAUTE's attempt to infect himself failed."

(238) WATSON (E. A.). i. **Report on Dourine.**—*Dept. of Agriculture, Canada. Report of the Veterinary Director-General* (F. Torrance, B.A., D.V.S.) *for the Year ending 31st Mar.* 1913. Ottawa : Printed by C. H. Parmalee. pp. 81-86.

ii. **The Serum Reactions and Serum Diagnosis of Dourine.**—*Ibid.* pp. 102-107.

i. Particular interest attaches to an outbreak of the disease at Unity, Saskatchewan, which the author investigated from March to July 1912. The cases were very mild, and there was some difference of opinion as to whether they were dourine or not. Very slow progress in the disease was observed, the animals differing little in condition when the author saw them two months after illness had first been observed ; in fact, according to some who had seen the animals, there was actual improvement.

Microscopic examination for the trypanosomes failed, but a positive agglutination reaction was obtained in dilutions up to 1 in 2000, and an increased globulin content in the blood was detected by the acetic acid test (see further paper by Watson). Positive reactions were obtained with blood from other mares, and some died from dourine during the course of the investigations. In one case *T. equiperdum* was discovered.

A tabulated statement gives a brief history of nine animals which came under observation.

In the case of the stallion from which the mares became infected the infection took about a year and a half to develop into a definable malady. Experience shows that in mares the disease may be latent during pregnancy and develop rapidly after parturition, infected animals then being a source of great danger to contacts.

During the period 1906 to 1912 Watson made numerous attempts to infect dogs, rabbits, mice and other laboratory animals with *T. equiperdum*, but without success. Only partial success followed the inoculation of large numbers of rats with a strain of the trypanosome which had been passed through a series of ten foals and had acquired a high degree of virulence. Although some of the rats became infected it was found impossible to carry on the strain.

Finally, after a large number of failures, a mouse was successfully inoculated from a mare upon which successive crops of plaques made their appearance. Subsequently there was no difficulty in carrying on the strain in the laboratory.

In mice death usually occurred on the fourth day, and in rats on the fifth. The virulence of the strain for these animals has increased until rats died in three days, and mice in 48 hours.

The strain has also increased in virulence for the horse. In two instances horses inoculated from rats have shown a heavy blood invasion, and one died from dourine in six weeks. Two dogs which licked the carcase became infected and died.

ii. The following reactions are considered by Watson to be of value for the diagnosis of dourine :—

1. Complement fixation test.
2. Agglutination test.
3. Precipitin test.
4. Acetic acid test.

Complement Fixation Test. The special point about this test as applied to the diagnosis of dourine lies in the method of preparing the antigen. The blood of a number of rats at the height of infection, but before they appear to be dying, is collected. It is defibrinated with glass threads and washed five or six times, the layer containing the trypanosomes being pipetted off each time. The final emulsion of trypanosomes in salt solution is diluted one in ten with salt solution, shaken for two or three days, and then passed through a Berkefeld filter. This filtered liquid constitutes the antigen.

The amboceptor, complement, and antigen are titrated and three tubes are prepared from each sample of serum to be tested. Positive and negative controls with known sera are used in every case, together with the usual general controls.

Agglutination Test. The antigen used in this test is the emulsion described above without filtration. Special care must be exercised in making the emulsion, and it must be rejected if for any reason it shows the slightest tendency to auto-agglutination. This may arise if the blood is collected when the animal is approaching death, if it be contaminated, etc.

A number of stock dilutions of serum are prepared, and from these series of dilutions from 1 in 20 to 1 in 10,000 are made. One cubic centimetre of such dilutions is placed in a series of tubes, to each of which are added two or three drops of the trypanosome suspension. A control tube containing only salt solution is included in the series. The tubes are incubated at 37° C. for one or two hours, and the reactions are noted every half hour.

The Precipitin Test. The antigen used in this test is exactly like that used for the complement test, save that it is not diluted.

In each tube 0·55 cc. of antigen is placed, and the serum is added by means of a capillary tube which is passed through the antigen to the bottom, the serum being then allowed to escape and carry the antigen up the tube without mixing with it. Three tubes should be used in each series so that pure serum, serum diluted 1 in 5, and 1 in 10 may be used. In tubes containing diluted sera the formation of a precipitin ring marks an absolutely specific result.

The Acetic Acid Test. This test is based upon NOGUCHI's observations regarding the increased globulin-content of the serum and cerebro-spinal fluid in cases of syphilis.

Watson replaces the butyric acid used by NOGUCHI by acetic acid, after having used butyric acid in a number of tests.

One cubic centimetre of serum is placed in a graduated centrifuge tube with 9 cc. of half-saturated ammonium sulphate. The tubes are allowed to stand for an hour, and the precipitated globulin is then sedimented by centrifuging. The clear liquid is then replaced by salt solution, in which the globulin dissolves.

This solution is then distributed into tubes in the following quantities:—1·75, 1·50, 1·25, 1·00, and 0·75 cc. The volumes are then made up to 2 cc. with salt solution, and finally 1 cc. of 10 per cent. acetic acid is added to each tube. The tubes are shaken, incubated for two or three hours at body temperature, and the results read off.

Normal sera give a slight opalescence in the first tube, and perhaps a faint cloudiness in the second, but with dourine sera there is marked cloudiness which gradually increases and after 24 hours settles to the bottom as a precipitate.

If more concentrated solutions are used the reaction occurs more quickly, but the differentiation is scarcely as well defined.

In cases of dourine a positive reaction may be obtained in the early stages of the disease. A reaction has been obtained a fortnight after experimental inoculation in a horse.

Watson has carried out the test with sera derived from cases of coital exanthema, glanders, influenza, fistulous withers, and one case of swamp fever. In the last-named a positive reaction was obtained. When the serum was tested by agglutination for dourine the result was negative.

The principal value of this test, perhaps, lies in the exclusion of dourine, for in no case of dourine of known history has the test ever given a negative result.

(239) Graham (L. W.) & Hutchison (R. H.). **The Influence of Experimental Trypanosomiasis upon the Body Temperature of White Rats.**—*Amer. Jl. of Trop. Dis. & Prevent. Med.* 1914. May. Vol. 1. No. 11. pp. 760-775. With 3 plates comprising 7 charts.

The experiments detailed in this paper were designed to investigate the question of the variations of body temperature in the rat under normal and abnormal conditions, and also after infection with trypanosomiasis.

The records were made with thermo-electric couples, a modification of the thermopile, as the mercury thermometer is not sufficiently sensitive. The operation of the apparatus depends upon the fact that when a junction of two dissimilar metals is heated a current is generated, such current being capable of measurement. The method is said to be accurate to one-tenth of a degree centigrade.

Readings of body temperatures were made at short intervals over comparatively long periods in normal rats kept under three sets of external conditions with regard to temperature, viz., room temperature, 37° C., and refrigerator temperature.

A similar series of readings were then taken with the same rats after infection with trypanosomiasis, and experiments were made both with pathogenic and non-pathogenic trypanosomes. The pathogenic trypanosomes used were *T. equinum*, *T. brucei*, and *T. evansi*, and the non-pathogenic *T. lewisi*.

The following conclusions are drawn :—

"1. In white rats experimental trypanosomiases cause no rise in body temperature.

"2. Pathogenic trypanosomes of high pathogenicity seem to decrease the power of thermal regulation in white rats under the influence of prolonged cold; but the non-pathogenic form, *T. lewisi*, does not show this effect.

"3. In white rats at ordinary temperature and under the influence of prolonged heat, none of the trypanosomes used in these experiments had any effect upon thermal regulation.

"4. From observations made upon the blood of infected rats it seems that conditions of prolonged heat and cold may possibly decrease the virulence of pathogenic trypanosomes without diminishing their pathogenicity."

(240) Noeller (W.). **Die Uebertragungsweise der Rattentrypanosomen. II Teil.** [The Method of Transmission of the Rat Trypanosome. Part II.]—*Arch. f. Protist.* 1914. June 17. Vol. 34. No. 3. pp. 295-335. With 2 plates and 3 text-figures.

Conclusions :—

1. Fleas become infected more easily upon freshly infected rats than upon rats suffering from chronic trypanosomiasis.

2. The flea of the fowl can live for weeks upon rat blood. It does not come into consideration as an actual transmitter of the rat trypanosome, as it passes little or no faecal matter during the process of feeding.

3. The developmental forms of the rat trypanosome observed by Prowazek, Baldrey, and Rodenwalt in the rat louse can be discovered with ease if the lice examined are taken from rats during the first week of infection.

4. In view of the fact that infectivity is soon lost after rat lice are removed from infected rats—according to Gonder in 20 days—the rat louse cannot be described as the true intermediate host of the parasite, if the view is held that a cycle of development must take place in the true carrier.

5. The rat louse excretes trypanosomes with the faecal matter.

6. Trypanosomes only find their way into the body cavity of the infected rat louse if the intestinal canal suffers injury.

7. Persistence of the trypanosomes in the rat louse, such as would be necessary for the production of a chronic infection of the louse, does not occur.

8. In the sheep ked (*Melophagus ovinus*), which can be fed upon rat blood for weeks, the trypanosomes retain their vitality for two days at 25° C., even if the ked has fed upon the blood of non-infected rats in the interval. Subsequently trypanosomes cannot be discovered in the ked. After 24 hours transition forms make their appearance in the ked, which resemble the so-called male trypanosomes from Glossina.

9. *Leptomonas ctenocephali* occurs in the larvæ of the dog flea also.

10. Among other parasites observed in the dog flea were: *Malpighiella refringens*, Minchin, and *Nosema pulicis*, Nöller. The gregarine *Actinocephalus parvus*, Wellmer, found in the dog flea larvae was probably derived from larvae of fowl fleas.

11. The following protozoa were observed in the fowl and pigeon fleas: Leptomonas spec., which occurs very frequently in the hind gut of full-grown fleas and larvae; *Legerella parva*, Nöller, 1913, in the Malpighian vessels of an adult flea; *Actinocephalus parvus*, Wellmer, in the intestines of all the larvae examined.

(241) Brown (W. H.). **A Note on the Pathogenicity of *Trypanosoma lewisi*.—*Jl. Exp. Med.* 1914. Apr. Vol. 19. No. 4. pp. 406-410.**

Attention is drawn to the fact that other authors have placed upon record the occurrence of pathogenic and non-pathogenic strains of *T. lewisi*, both as regards the rat and as regards the mouse.

The author has encountered a strain of *T. lewisi* which for a time shewed a marked increase in virulence for the rat.

A strain of the trypanosome, the origin of which was not known, but which had been carried on for several years in white rats without shewing any unusual pathogenic effects, appeared to acquire a degree of virulence which rendered it fatal to rats by intraperitoneal inoculation with a drop or two of infected blood.

Of eight rats inoculated intraperitoneally with 0·2 cc. of defibrinated blood mixed with 0·8 cc. of salt solution, two died on the sixth day, one on the seventh, and the remainder on the ninth day after inoculation. The symptoms shewn were torpidity, weakness, anaemia, dyspnoea, in some cases blood-stained nasal and lachrymal discharges, and in all cases diarrhoea.

Careful examination failed to reveal any cause of death other than trypanosomiasis.

At the post-mortem examination the rats shewed acute enteritis, splenic enlargement, hyperplasia of the bone marrow, and a few necrotic foci in the liver. Some of the rats shewed congestion of the lungs, but in no case was there any pneumonia.

Immune and control rats remained healthy.

A number of observations have been made upon normal and immune rats inoculated with different strains of *T. lewisi*, and these shew that such conditions may occur frequently in a series of inoculations, while they do not occur in control or immune rats or in rats inoculated from other sources. With one exception symptoms of the same nature have not been observed in rats placed in contact with rats exhibiting them. In sub-inoculations the strain became less virulent again.

(242) Brown (W. H.). **Morphological and Developmental Anomalies of a Pathogenic strain of *Trypanosoma lewisi* and their Relationship to its Virulence.—*Jl. Exp. Med.* 1914. June. Vol. 19. No. 6. pp. 562-569. With 2 plates comprising 22 figures.**

The strain of *Trypanosoma lewisi* referred to in the previous paper was found to possess several morphological and developmental peculiarities. Attention was first drawn to the possibility of some connection existing between the pathogenicity and the morphology of *T. lewisi* by Wendelstadt and Fellmer, who passed the trypanosome through cold-blooded animals and thus produced certain alterations in these characteristics. The author, therefore, followed up his pathogenic strain of *T. lewisi* through 82 rats, special attention being paid to the nature of the infection.

The details of experiments in which different series of infections were compared with parallel series in which a typical strain was used are reserved for another paper.

In the present paper only those deviations from the normal are described which were pronounced and occurred with sufficient frequence to be considered characteristic of the particular strain or infection. Most of the peculiarities have been observed before, but some of them are comparatively rare.

Two different types of multiplication forms were observed in addition to the usual forms. Figures are given which represent the two types, but it is a little difficult to appreciate what are the special characters of the multiplying forms. It is said that the trypanosomes may multiply very rapidly, producing a large number of irregular or small forms, or they may multiply slowly, the process continuing beyond the period at which it usually comes to an end.

Trypanosomes were found which possessed certain morphological features which were not normal. The variations observed involved all the structural features of the organism. The occurrence of trypanosomes containing no nuclei is referred to, and the occurrence of trypanosomes devoid of centrosomes is somewhat emphasised.

It is suggested that there is a correlation between the morphological and developmental characters and the virulence of the organism.

(243) Laveran (A.) & Roudsky (D.). **Contribution à l'Etude de la Virulence du *Trypanosoma lewisi* et du *Tr. duttoni* pour Quelques Espèces Animales.** [The Virulence of *T. lewisi* and *T. duttoni* for Various Species of Animals.]—*Bull. Soc. Path. Exot.* 1914. June. Vol. 7. No. 6. pp. 528-535.

In this paper the authors give brief details of a number of experiments in which rodents of different species were inoculated with *T. lewisi* and *T. duttoni*, and the following summary is given :—

When small rodents such as wood-mice, voles, dormice, meriones, gerbils, jerboas, and guinea-pigs are inoculated intraperitoneally with the blood of rats rich in *T. lewisi*, there is as a rule produced an infection of variable intensity. In some cases the trypanosomes are very scantily present in the blood and disappear in 24 to 48 hours, and in other cases there is a well-marked infection, trypanosomes increasing in numbers, dividing forms being numerous, and the blood invasion being persistent. Even in those cases in which the infection is abortive, it is not a simple matter of the trypanosomes simply passing into the blood, but an actual infection, as the animals thereby acquire immunity to *T. lewisi*.

In rodents other than rats, inoculations in series with *T. lewisi* have not succeeded, but examination of the records of the infections of rodents with *T. lewisi* suggests that it would not be difficult to obtain strains of *T. lewisi* acclimatised for different species, in the same manner as one can obtain strains of *T. lewisi* inoculable in series for the mouse and strains of *T. duttoni* inoculable in series for the rat.

(244) Yorke (W.) & Blacklock (B.). **Observations on a so-called Cure for Trypanosomiasis.**—*Ann. Trop. Med. & Parasit.* 1914. Apr. 21. Vol. 8. No. 1. pp. 51-53.

At the request of the British South Africa Company the authors have tested a serum supplied by H. C. Sieg and reputed to be of great value for the treatment of trypanosomiasis. The conclusion drawn is that the sera supplied had not the slightest therapeutic value in animals experimentally infected with pathogenic trypanosomes.

(245) YORKE (W.) & BLACKLOCK (B.). **Antimony trioxide in the Treatment of experimental Trypanosomiasis.**—*Ann. Trop. Med. & Parasit.* 1914. Apr. 21. Vol. 8. No. 1 pp. 55-72.

The antimony trioxide—"trixidin"—used in the experiments detailed in this paper was in part supplied by KOLLE and in part prepared by the authors.

The drug was administered by intramuscular injection in the majority of cases, but in some instances intraperitoneal and intravenous injections were made. For the intramuscular injections 10 and 40 per cent. suspensions in oil were prepared. For the intraperitoneal injections 1 per cent. suspensions in salt solution were employed. For the intravenous injections the drug in a very finely divided form was suspended in distilled water. This was allowed to stand for 18 hours, the liquid then being drawn off and estimated as to the quantity of the drug present in it.

The best results were obtained by intramuscular injection, but it was found that the amount of the drug absorbed was extremely small. Six months after administration it could be found at the seat of injection in an unaltered condition. The drug was immediately deposited from the suspension used for the intravenous injections and caused plugging of the veins.

A great disadvantage of the intramuscular administration was that in many cases it gave rise to the formation of sterile abscesses.

Small animals appear to be far more tolerant of the drug than large ones. At least 1 mgm. per 10 gm. body weight can be administered to rodents without untoward results. Such doses administered to donkeys and dogs frequently caused death, and far smaller doses were always followed by abscess formation at the seat of injection.

In cases in which the administration of the drug caused a disappearance of trypanosomes from the circulation there were sometimes relapses after very long periods, amounting to more than a hundred days.

The following strains of trypanosomes were used:—*T. rhodesiense*, *T. brucei*, *T. ugandae*, *T. evansi*, *T. equiperdum*, *T. congolense*, *T. equinum*, *T. gambiense*, and *T. lewisi*. With the exception of the last two of these all the strains appeared to be very susceptible to the drug, trypanosomes disappearing from the circulation within 48 hours after the injection. The strains of *T. gambiense* and *T. lewisi* proved to be very refractory. Relapses occurred even among the susceptible strains, and in the case of the following trypanosomes such relapses occurred after trypanosomes had disappeared from the blood for a period of 100 days or more: *T. rhodesiense*, *T. ugandae*, *T. vivax*, and *T. equiperdum*.

In agreement with what was observed regarding the curative effect of the drug upon *T. rhodesiense* and *T. gambiense*, it was found that it exerted a prophylactic effect against the former, but not against the latter.

(246) LURZ (R.). **Heilungsversuche mit Salvarsan bei Schlafkrankheit.** [The Curative Treatment of Sleeping Sickness with Salvarsan.]—*Arch. f. Schiffs- u. Tropen.-Hyg.* 1914. May. Vol. 18. No. 10. pp. 335-339.

This paper records the results obtained in the treatment of 16

cases of the disease, most of which were in the advanced stages. The dose generally employed was 0·3 gm., and it was repeated in from one to four days, but on some occasions slightly larger doses were given.

In some cases repeated injections produced no symptoms, but in others there was fever, associated with pains in the head, thorax and abdomen, vomiting, and in one instance pains in the joints. The symptoms began to disappear in about five hours.

In every case the treatment caused a reduction in the size of the glands and a disappearance of trypanosomes from the blood.

The patients were kept under observation for periods varying from three and a half to five and a half months.

The following is a resumé of the results :—

One patient in whose spinal fluid trypanosomes had been found died. In six cases relapses occurred, but the general condition of the patients remained unaltered. In one case there was marked loss of condition, but trypanosomes were not found in either the blood or the cerebro-spinal fluid. In the remaining eight cases trypanosomes were not again observed.

Improved results were not obtained when mercury was used in conjunction with the salvarsan.

(247) Vorwerk. **Versuche mit Salvarsan bei Schlafkrankheit.** [Experiments with Salvarsan in the Treatment of Sleeping Sickness.]—*Arch. f. Schiffs- u. Tropen.-Hyg.* May. Vol. 18. No. 10. pp. 329-335.

This paper gives the results obtained in the treatment of twelve cases of sleeping sickness in German East Africa. The majority (ten) of the patients shewed glandular swellings, but were otherwise in good condition (second stage). The remainder were at more advanced stages of the disease.

The drug was administered by intravenous injections in doses of 0·4 grammes.

The following conclusions are drawn :

1. A single administration of a moderate dose of salvarsan intravenously during the second stage of the disease causes the immediate disappearance of the trypanosomes from the glands and the circulation.

2. Relapses occur in almost every case after intervals varying from a fortnight to six months, whether single or repeated doses are administered.

3. The drug is contra-indicated in the case of patients in the third stage of the disease—that is to say, when they are in poor condition or show nervous symptoms, as it is dangerous.

4. Salvarsan is of less value for the permanent cure of the disease than atoxyl, treatment with which has not infrequently been followed by long periods during which the patients have been free from relapses.

(248) Macfie (J. W. Scott). **On the Pathogenicity of the Trypanosome (*T. nigeriense*) from a Case of Sleeping Sickness from Eket, Southern Nigeria.**—*Ann. Trop. Med. & Parasit.* 1914. April. Vol. 8. No. 1. pp. 29-39.

This paper contains an account of further experiments with the trypanosome isolated by Foran from cerebro-spinal fluid from a case of sleeping sickness at Eket.

The trypanosome was originally isolated by inoculation of a guinea-pig. Some of the experimental inoculations were made with the blood of two further guinea-pigs inoculated from this one, and also from a monkey apparently deriving its infection from the same source.

Of eight rats inoculated only one became infected, and in this animal only a single trypanosome was found on the 59th day.

Seven wild mice were inoculated. Four became infected, but the trypanosomes were very scantily present in the blood. The period of incubation was five to nine days. The disease ran a very chronic course, and did not appear to be responsible for death in any instance.

Three out of twelve guinea-pigs inoculated became infected. Parasites were fairly constantly present in the blood but never in very large numbers. The period of incubation was 27 days, and in one case the animal died on the 158th day.

In one dog out of seven trypanosomes were found on the 85th day and were subsequently found to be present in small numbers. The dog was alive and apparently in good health on the 115th day.

Two monkeys were successfully inoculated from the original guinea-pig. The infection was very chronic and the monkeys were still alive and apparently well on the 118th and 137th days.

One of two goats inoculated became infected. Trypanosomes were found to be very scantily present on two occasions only.

The evidence is said to be in favour of this trypanosome being a new species.

(249) Delanoë (P.). **Des Variations du Pouvoir Infectieux et de la Virulence de *Trypan. dimorphon* L. et M. (suite). Deuxième Note.** [Variations in the Infectivity aud Virulence of *Trypanosoma dimorphon* L. and M. Second Note.]—*Bull. Soc. Path. Exot.* 1914. Apr. Vol. 7. No. 4. pp. 281-289.

(For abstract of the Preliminary Note, see this *Bulletin*, Vol. 2, No. 1. p. 68.)

In this paper the author gives at length a description of the experiments carried out with a strain of *T. dimorphon* derived from a naturally infected ox, which at the outset was not inoculable for the white rat and the guinea-pig, and which after a series of experiments became pathogenic for both of these species and capable of causing a fatal infection in the former. The experiments do not as yet warrant any statement as to whether the trypanosome is fatal for the guinea-pig.

The strain acquired the power of infecting the rat after one passage through a kid and one through a dog. The strain became pathogenic for the rat after the first passage through the rat.

The author also found that when, after inoculation with the trypanosome, there was no blood invasion, the animal acquired no immunity.

The strain became infective for the guinea-pig after the following passages: one through a kid, followed by one through a dog, a second through a kid and one through a white rat.

The conclusion drawn is that it is difficult to demonstrate the susceptibility of the white rat and the guinea-pig to *T. dimorphon*, and that a trypanosome can be said to be non-pathogenic for a particular species only after repeated and varied experiments.

(250) Kleine (F. K.), Fischer (W.) & Eckard (B.). **Ueber die Bedeutung der Speicheldrüseninfektion bei der Schlafkrankheitsfliege (*Glossina palpalis*). II Mitteilung.** [The significance of the Infection of the Salivary Glands in *Glossina palpalis*. Second Part.]—*Zeitschr. f. Hyg. u. Infektionskr.* 1914. May 27. Vol. 77. No. 3. pp. 495-500.

An abstract of the first communication on this subject will be found on page 282 of Volume 1 of this *Bulletin*.

In this paper the authors detail some experiments regarding the path by which trypanosomes (*T. gambiense*) reach the salivary glands.

The possibility was considered that it might be from the body cavity. Laboratory-bred flies were given four feeds upon monkeys infected either with *T. gambiense* or *T. rhodesiense* and were then fed upon healthy monkeys until these were found to be infected. The whole batch of flies used in the particular experiment were then killed by chloroform.

In order to obtain fluid from the body cavity two methods were adopted. In the majority of cases the legs were cut off close to the thorax, and the liquid made to exude from the abdominal and thoracic cavities by slight pressure upon the wounds with a slide. In the other cases a transverse slit was made about the middle of the under surface of the abdomen, and from this a cut was made upwards. The exuding liquid was collected in a capillary pipette, films being subsequently made from it.

In 21 experiments 215 flies were used, and of these at least 21 actually became infected.

A further batch of 207 flies which had had a single meal on an infected monkey and were then fed upon healthy animals were examined, but in this case the question of the infectivity of the flies was not actually determined.

In no cases were any trypanosomes found in the fluid obtained from the body cavities, although in the second batch of flies eleven were found to have numerous trypanosomes in their intestines, and were consequently on the way to becoming infective, if not actually so.

Previously to carrying out the experiments mentioned the authors had examined the fluid from the body cavities of nine infected flies and in three instances had discovered trypanosomes. They, however, believe that these discoveries were probably due to faulty technique.

(251) Hagemeister (Wolfgang). **Ueber die Zuchtung pathogener Trypanosomen auf künstlichen Nährböden.** [The Cultivation of Pathogenic Trypanosomes in Artificial Media.]—*Zeitschr. f. Hyg. u. Infektionskr.* 1914. Apr. 1. Vol. 77. No. 2. pp. 227-256.

The medium used by the author in his later experiments was as follows :—

Extract of 125 gm. of beef or horse flesh in 1000 cc. of distilled water.
20 gm. of agar.
20 gm. of peptone.
5 gm. of sodium chloride.

The reaction of the medium was neutralised and 5 cc. of normal soda solution added in excess. There was also added 2 per cent.

of dextrose on the lines recommended for the cultivation of malarial parasites and piroplasms.

To this medium two or three times the volume of sterile defibrinated blood was added. It was found that the addition of dextrose obviated the necessity of using rabbit blood, this being replaced successfully by goat, horse, donkey, and calf blood. The tubes were sealed with paraffin wax.

The trypanosomes used were the "Ferox" stain of nagana and the Eastern Prussian strain of *T. equiperdum*.

The seed material for the cultures consisted of heart blood of rats and mice which had been inoculated intraperitoneally. The blood was drawn from the still beating hearts of heavily infected animals into capillary tubes containing salt solution. Two or three drops of this mixture were used for the inoculation of each tube. The tubes were kept in the dark at room temperature.

Experiments were first made with the trypanosome of the *theileri* type occurring in cattle in Germany. It was found possible to obtain growths in those tubes only which contained ox blood and were incubated. Only 50 per cent. of these tubes shewed any growth, and in these there was active growth from the fifth day onwards. Trypanosomes began to decrease in numbers from the twelfth day and had disappeared by the eighteenth day. Sub-cultures were obtained in tubes of medium containing goat blood.

With the *T. brucei* the author was never able to find trypanosomes in his cultures after the eleventh day, and in no case were they numerous. There were no rosettes formed. A series of tubes to which goat blood was added succeeded in only 20 per cent. and in these trypanosomes were visible for four days only.

Parallel series of tests were made, and it was found that the tubes containing bloods other than rabbit blood and to which dextrose had been added yielded better results than the Novy medium as originally described.

The addition of dextrose to media containing rabbit blood did not improve them.

Conclusions:

Multiplication of ox trypanosomes of the *T. theileri* type on media containing ox blood and incubated at 37° C. occurs in the first generation only. But subcultivation succeeded with trypanosomes of this species when media containing goat blood were used.

The addition of dextrose has a beneficial effect upon the vitality of the trypanosomes and upon their capacity for multiplying in vitro.

The addition of dextrose to other kinds of blood (goat, horse, donkey, calf) not only replaced the expensive rabbit blood, but actually rendered them superior to it. Dextrose did not exert any beneficial effect upon media containing rabbit blood.

Trypanosomes cultivated upon media containing dextrose retained their infectivity, but lost their virulence to some extent.

A number of passages through cultures does not render the pathogenic trypanosomes more suitable for cultivation in vitro, but their vitality is thereby decreased and their virulence is rapidly diminished.

T. brucei retains its virulence in cultures better and with more regularity than *T. equiperdum*.

(252) PRINGAULT (E.). *Cimex pipistrelli*, **Jen., Agent de la Transmission de la Trypanosomiase des Chauves-souris.** [*Cimex pipistrelli*, Jen., the Transmitting Agent of Trypanosomiasis in Bats.]—*Compt. Rend. Soc. Biol.* 1914. June 5. Vol. 76. No. 19. pp. 881-883.

The author has carried out experiments indicating that bugs act as the transmitting agent of *Trypanosoma vespertilionis*.

(253) PRINGAULT (E.). **Non-pathogenicité du *Trypanosoma vespertilionis* (Battaglia) pour les Animaux de Laboratoire.** [The Non-Pathogenicity of *T. vespertilionis* for Laboratory Animals.]—*Compt. Rend. Soc. Biol.* 1914. June 5. Vol. 76. No. 19. pp. 883-884.

The author is in agreement with SERGENT, NICOLLE, and COMTE in finding this trypanosome non-pathogenic for laboratory animals, and disagrees with BATTAGLIA, who successfully infected guinea-pigs and rabbits.

(254) MAYER (M.) & DA ROCHA-LIMA (H.). **Zum Verhalten von *Schizotrypanum cruzi* in Warmblütern und Arthropoden.** [*Schizotrypanum cruzi* in Warm-blooded Animals and Arthropods.]—*Arch f. Schiffs- u. Trop.-Hyg.* 1914. Beiheft 5. Vol. 18. pp. 101-136. With 2 coloured plates.

Summary.

1. A description is given of the course of the infection when passed through monkeys, guinea-pigs and mice, and particular interest attaches to the occurrence of relapses after long periods (in one case after eight months in the guinea-pig).

2. In most cases recovery renders rats, rabbits, and guinea-pigs resistant to re-infection. The serum of such immune animals was found to have no therapeutic effect when injected 24 hours before and simultaneously with infective material.

3. Complement-fixation experiments with serum and extracts of organs from infected animals did not give any results different from those given by controls.

4. Dividing forms, save those already described by CHAGAS, in which nuclear division was just commencing, were never seen in the peripheral blood. Leishmanial forms were frequently observed.

5. Examination of sections shewed that the Schizotrypanum multiplies by division within the tissue cells, the parasites being rounded or spindle shaped as a result of pressure, and that the size and form of the parasite is retained during multiplication. Finally small individuals are produced at the last division which rapidly develop into trypanosomes. These leave the host cell after a short time (the time varying with the tissue) and invade the blood stream.

6. The normal development of the Schizotrypanum within the tissue cells does not appear to injure these in any way. Even the mechanical effects produced by large groups of parasites are rapidly and completely repaired, at least in muscle fibres. Toxic substances appear to be produced when the parasites are injured in any way. Altered host cells may contain parasites which have abnormal morphological and developmental features. There is no direct connection apparently between the formation of a colony of parasites in organs and symptoms of general degeneration or disturbance of function. A causal connection is only established when parasites are destroyed in large numbers. In such cases there may be destruction of the host cells and not infrequently evidence of wide-spread inflammatory changes. There is therefore no basis for explaining clinical symptoms and anatomical alterations on the grounds of the discovery of uninjured developing parasites.

7. Animals of the same kind, infected in the same manner, and shewing the same clinical picture, shew on microscopic examination of their organs the widest differences in the extent and severity of the lesions and in the distribution of the parasite. The most severe lesions are generally found in the stripped muscular tissue. The fatty tissue was frequently the seat of extensive degeneration. The other organs, although they frequently contained colonies of parasites, in most cases shewed no lesions.

8. The development of the parasite in *Conorhinus megistus*, *Acanthia lectularia* and *Ornithodorus moubata* was followed more closely. Transmission by biting was not determined with certainty in a large number of series (two doubtful positive results). The ingestion of infected ticks by mice and the bites of such ticks in no case caused infection.

9. No development occurred in *Stegomyia calopus* and *Culex pipiens*.

10. Experiments with the various "trypanotropic" drugs have yielded only unsatisfactory results up to the present.

(255) Blacklock (B.). **The Multiplication and Infectivity of *T. cruzi* in *Cimex lectularius*.**—*Brit. Med. Jl.* 1914. Apr. 25. No. 2782. pp. 912-913

The experiments described were undertaken in order to ascertain whether *T. cruzi* is capable of existing and developing in *Cimex lectularius*, and if so, whether the forms found in the bed bug are capable of infecting laboratory animals when injected into them, or when the bugs feed on the animals.

Conclusions :—

"1. *T. cruzi* is capable of living and multiplying in *Cimex lectularius* for long periods.

"2. The parasites found in the bed bug are infective on inoculation as early as 21 hours and as late as 77 days from the infecting feed.

"3. It is not possible to say which of the many different forms occurring in the bug causes infection in the vertebrate host.

"4. Transmission of the disease to healthy animals by feeding infected bugs on them is of very rare occurrence. It was only once observed in the course of these experiments.

"5. There is no evidence of the hereditary transmission of *T. cruzi* in *Cimex lectularius*."

LEISHMANIASIS.

(256) Caronia & di Giorgio (G.). **Sulla Leishmaniosi spontanea nei Cani di Palermo.** [Spontaneous Canine Leishmaniasis in Palermo.] —*Pathologica.* 1914. Apr. 15. Vol. 6. No. 131. pp. 208-209.

This brief paper gives the results of the examinations carried out on dogs during the twelve months ending August, 1913. One thousand and five dogs were examined and only one was found to be infected.

(257) Pittaluga (G.). **Kala Azar Infantile e Leishmaniosi canina in Ispagna.** [Infantile Kala Azar and Canine Leishmaniasis in Spain.] —*Pathologica.* 1914. Mar. 1. Vol. 6. No. 128. pp. 121-123.

The author records the discovery of two cases of spontaneous canine leishmaniasis at Tortosa, and one at Beninar, in Almeria. Cultures were successfully made.

(258) da Silva (P.). **Notes sur le Kala Azar.** [Notes on Kala Azar.] —*Arquiv. do Instit. Bact. Camara Pestana.* 1914. June. Vol. 4. No. 2. pp. 147-172. With 2 plates and 3 text figs.

During the period May, 1910, to March, 1911, 300 dogs were examined and eight were found to be infected with Leishmania. The spleen, bone marrow, and liver were examined. Subsequently seven other dogs were examined, and one found infected.

During the period March to June 1912, a fresh series of examinations was made and four infected dogs were found among 109 examined. In these instances only the spleen was examined.

Details are given of 12 dogs which were used for experimental inoculations, the virus in one experiment having been obtained in the first instance from a case of the disease occurring in a human being (a girl of nine years of age). In other cases the infection was transmitted by inoculation from a naturally infected dog to others.

In experimentally infected dogs no symptoms are said to be observed. A diagnosis must be based upon the detection of the parasite in the liver or in the bone marrow. It is difficult or impossible to locate the spleen by palpation and therefore spleen puncture was not resorted to. The author prefers the examination of bone marrow to that of material obtained by liver puncture as being more certain.

Cultivation upon NNN medium is more certain than microscopic examination for the detection of the parasite.

The belief is stated that the skin lesions that have been described as occurring in cases of canine leishmaniasis are due to follicular mange and not to the leishmaniasis.

It was found to be possible to transmit both the human and canine strains to dogs by inoculation.

In the author's opinion only two of the experimentally infected dogs actually died of the disease, death in other instances being due to follicular mange.

A number of experiments have been carried out regarding the transmission of leishmaniasis with fleas, both *Pulex irritans* and *Ctenocephalus canis*, and, though very definite results have not been obtained, the author appears to incline to the view that fleas play a part in the transmission.

(259) Pringault (E.). **La Leishmaniose canine à Marseille.** [Canine Leishmaniasis at Marseilles.]—*Bull. Soc. Path. Exot.* 1914. June. Vol. 7. No. 6. pp. 484-488.

During the period December to May the author has examined 310 dogs of various species and has found five infected with Leishmania. He gives his reasons for believing that these dogs have not been imported from places where canine leishmaniasis exists, and reaffirms his statement that canine leishmaniasis actually occurs at Marseilles.

(260) Nicolle (C.) & Conor (Marthe). **Difficulté de Conservation du Virus de la Leishmaniose Canine par les Passages.** [The Difficulty of preserving the Virus of Canine Leishmaniasis by Passage.]—*Bull. Soc. Path. Exot.* 1914. June. Vol. 7. No. 6. pp. 481-484.

The authors referred to this difficulty in 1912 [see this *Bulletin*, Vol. 1, pp. 109–110], and the present paper contains a detailed description of a fresh series of experiments of the same nature as those originally described.

The following is a summary of the results obtained :—

At the first passage two dogs out of three were certainly infected, and three monkeys out of four were probably infected.

At the second passage one monkey out of four became infected, but the inoculation failed in the case of three dogs.

At the third passage two mice and one of two monkeys became infected.

At the fourth passage three monkeys and two mice were inoculated without success.

The canine virus appears to be more difficult to maintain by passage than the human virus, and it is a curious fact that the virus isolated from a naturally infected dog appears to be less virulent for the dog than the human strain.

The impossibility of protecting dogs from infection with piroplasmosis in Tunis increases the difficulties of maintaining the virus.

(261) Nicolle (C.). **Chronique du Kala Azar en Tunisie.** [Kala Azar in Tunis.]—*Bull. Soc. Path. Exot.* 1914. June. Vol. 7. No. 6. pp. 479-481.

Since the publication of statistics in the Archives of the Pasteur Institute, Tunis, in 1912, eight additional cases of the disease have been observed in the human subject, making 38 cases in all. In addition, there has been one case recorded in a child in Algeria. All the cases save one occurred in children under three years of age, and six were in boys.

During 1913, 109 dogs were examined. The animals were principally selected from among animals whose appearance raised the suspicion that they might be infected. Six cases were detected, four severe and two moderate.

During September 20 cats were examined, but with negative results in every case.

Five strains of parasites are kept in artificial culture; two from cases of kala azar, two from naturally infected dogs, and one from a case of oriental sore. NNN medium is used, and subcultures are made twice monthly. The parasites have been maintained without morphological alteration through from 56 to 119 generations.

All the cultures grow easily and form little transparent colonies on the surface of the blood-agar.

The authors draw attention to the occurrence of splenic anaemia in children only a few months old, the cause of which has not been determined.

(262) Row (R.). **Generalised Leishmaniasis induced in a Mouse with the Culture of *Leishmania tropica* of Oriental sore.**—*Bull. Soc. Path. Exot.* 1914. Apr. Vol. 7. No. 4. pp. 272-277.

The author has succeeded in producing a generalised infection by inoculating a mouse intraperitoneally with cultures of *L. tropica*. Three inoculations were given on three successive days, using cultures varying from four to seven weeks old, and a final inoculation was given two months later. The mouse was killed nine months after the final inoculation. The spleen was six to eight times the normal size, and the liver was distinctly enlarged. The peritoneum appeared to be normal. The parasites were present in large numbers in the spleen, liver, and bone marrow, and cultures were raised from them. Films of the heart blood showed "large cocci-like dots occupying apparently the red cells singly." That these bodies were not cocci was shown by the fact that they could not be cultivated upon agar.

This appears to furnish evidence that *L. tropica* and *L. donovani* may be identical, in spite of the different clinical aspects of oriental sore and kala azar.

(263) Wenyon (C. M.). **Demonstration by Dr C. M. Wenyon of some smears made by** Dr. Neligan **from Oriental Sore in Dogs in Teheran, Persia.**—*Trans. Soc. Trop. Med. & Hyg.* 1914. June. Vol. 7. No. 6. pp. 215-216.

"Dr. C. M. Wenyon showed some specimens, under the microscope, of smears made by Dr. Neligan from oriental sore in dogs, in Teheran, Persia, and made the following statement with regard to them:—

"Dr. Neligan, who was the first to demonstrate leishmania in the skin lesions of dogs, tells me that oriental sore is very common, both in human beings and in dogs, in Teheran. Dr. Neligan's discovery of oriental sore in dogs is of much interest in that it places this disease on the same footing as kala-azar, which is known to occur naturally both in human beings and dogs. A further observation which Dr. Neligan has made is that leishmania not only occur in the sores about the heads of the dogs, but that they also occur in the internal organs. Dr. Neligan has sent me smears of the organs of dogs which had oriental sore and in the bone marrow fair numbers of leishmania occur. Here is a difficult question to settle. Does the presence of leishmania in the organs mean that the dogs are suffering from a general infection with *Leishmania tropica*, the parasite of oriental sore, or does it mean that in Teheran there occurs also canine kala-azar, and that the dogs with the general infection, as well as the local skin lesions, are suffering from both diseases, oriental sore and kala-azar? A mere examination of the films cannot answer this question, which can only be settled on the spot by further observations and experimental work."

SPIROCHAETOSIS.

(264) Macfie (J. W. Scott) & Johnston (J. E. L.). **A Note on the Occurrence of Spirochaetosis of Fowls in Southern Nigeria.**—*Ann. Trop. Med. & Parasitol.* 1914. Apr. Vol. 8. No. 1. pp. 41-45. With 2 plates.

The disease, which is well-known among the natives, was first brought to the notice of the authors as occurring in Muscovy ducks, but subsequently it spread to the fowls in the same compounds.

The symptoms were those usually observed in spirochaetosis. On post-mortem the liver and spleen were found to be greatly enlarged, the former containing necrotic patches of considerable size.

The parasite appeared to resemble very closely that described by Balfour as occurring in the Soudan.

Atoxyl and salvarsan were tried in a very small number of cases and the results appeared to indicate that salvarsan would yield the better results.

The authors were unable to convince themselves of the presence of "after phase" bodies described by Balfour, and had no opportunity to carry out any immunity tests with the object of determining the identity of the parasite.

(265) Launoy (L.) & Lévy-Bruhl (M.). **Le Sang de la Poule dans la Spirillose expérimentale.** [The Blood of the Fowl in Experimental Spirillosis.]—*Ann. Inst. Past.* 1914. May. Vol. 28. No. 5. pp. 517-539. With one coloured plate.

Conclusions :—

1. Infection of adult fowls with *Spirochaeta gallinarum* sets up a very marked and rapid anaemia, the number of blood corpuscles being in some cases reduced to half the normal in five days. This phenomenon is the most characteristic from the haematological point of view. The intensity of the anaemia and some of the characters possessed by it cause spirillosis to resemble the so-called pernicious anaemias. But this disease differs from the pernicious anaemias in that there is a rapid and complete regeneration of the blood within a fortnight after the crisis.

2. The anaemia and the regeneration of the blood are accompanied by variations in the leucocytes which follow a constant cycle.

Day of Disease.	Clinical.	Red Corpuscles.	White Corpuscles.
1 to 2	Incubation ..	Commencing anaemia	Leucocytosis with polynuclears having rod-shaped granules.
3 to 5	During attack	Progressive destruction	Leucocytosis with neopolynuclears.
5 to 6	Crisis	Maximum anaemia ..	Leucopenia.
6 to 10	Convalescence	Regeneration.	Mononuclear leucocytosis.
,,	Recovery	Normal.	Normal, slight leucocytosis or sometimes prolonged mononuclear leucocytosis.

3. The spleen appears to play no part in these modifications in the blood. Splenectomy does not influence the series of changes indicated in the table.

(266) Bronfenbrenner (J.). **A Simplified Method for Cultivating Spirochaetes on Liquid Media.**—*Proc. Soc. Exp. Biol. & Med.* 1914. June. Vol. 11. No. 6. pp. 185-187. With 1 text fig.

The method described is a modification of Noguchi's method, and was devised in order to obviate the use of a rubber stopper connection between the upper and lower parts of the apparatus, as this often becomes a source of contamination of the culture.

The new method may be used in two ways :—

1. A single tube replaces the two tubes joined by a rubber bung in Noguchi's method. A piece of rabbit kidney is placed in the bottom of the tube, which is then drawn out at about its middle point to form a constriction. It is then filled with ascitic broth or sheep serum water to the point where the tube broadens out again above the constriction. Another piece of tissue is placed in the upper portion of the tube and this is filled with ascitic agar, preferably 1 per cent. In this the spirochaete culture is placed. Sterile paraffin oil in a thin layer is then placed above the agar and the tube incubated.

2. A better way is as follows: A piece of tissue is placed in the bottom of a tube, which is then drawn out as before. By means of a capillary pipette the spirochaete culture and ascitic broth are introduced into the bottom of the tube. A bung is fitted into the mouth of the tube, through which passes a glass tube shaped like the letter **Y**, with the two upper arms projecting freely. One of these is connected to an exhaust pump and the other to a reservoir of sterile paraffin oil. The tube is exhausted by the pump, the tube being immersed in water at 37° C. to facilitate the exhaustion. After exhaustion, the cock below the oil reservoir is opened and the oil is allowed to run down on to the surface of the medium, the negative pressure in the tube assisting this. The tube is then sealed off at the constriction. It is said that the oil makes it possible to keep the spirochaetes alive after the tube is once opened. The author has kept his cultures going in this way for three months.

MALARIA AND MISCELLANEOUS HAEMO-PARASITES.

(267) Seidelin (H.) & Connal (A.). **A Note upon the Occurrence of a Plasmodium in the Blood of West African Monkeys.**—*Ann. Trop. Med. & Parasit.* 1914. Apr. 21. Vol. 8. No. 1. pp. 81-82.

The authors have discovered parasites belonging to the genus Plasmodium in each of three young monkeys examined at the Medical Research Institute at Yaba, near Lagos. Two of the monkeys were *Papio sphinx*, and the other was a *Cercopithecus mona*. The parasites were very scantily present, but in two of them both gametocytes and schizonts were seen.

SPIROCHAETOSIS.

(264) Macfie (J. W. Scott) & Johnston (J. E. L.). **A Note on the Occurrence of Spirochaetosis of Fowls in Southern Nigeria.**—*Ann. Trop. Med. & Parasitol.* 1914. Apr. Vol. 8. No. 1. pp. 41-45. With 2 plates.

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The method described is a modification of Noguchi's method, and was devised in order to obviate the use of a rubber stopper connection between the upper and lower parts of the apparatus, as this often becomes a source of contamination of the culture.

The new method may be used in two ways:—

1. A single tube replaces the two tubes joined by a rubber bung in Noguchi's method. A piece of rabbit kidney is placed in the bottom of the tube, which is then drawn out at about its middle point to form a constriction. It is then filled with ascitic broth or sheep serum water to the point where the tube broadens out again above the constriction. Another piece of tissue is placed in the upper portion of the tube and this is filled with ascitic agar, preferably 1 per cent. In this the spirochaete culture is placed. Sterile paraffin oil in a thin layer is then placed above the agar and the tube incubated.

2. A better way is as follows: A piece of tissue is placed in the bottom of a tube, which is then drawn out as before. By means of a capillary pipette the spirochaete culture and ascitic broth are introduced into the bottom of the tube. A bung is fitted into the mouth of the tube, through which passes a glass tube shaped like the letter **Y**, with the two upper arms projecting freely. One of these is connected to an exhaust pump and the other to a reservoir of sterile paraffin oil. The tube is exhausted by the pump, the tube being immersed in water at 37° C. to facilitate the exhaustion. After exhaustion, the cock below the oil reservoir is opened and the oil is allowed to run down on to the surface of the medium, the negative pressure in the tube assisting this. The tube is then sealed off at the constriction. It is said that the oil makes it possible to keep the spirochaetes alive after the tube is once opened. The author has kept his cultures going in this way for three months.

MALARIA AND MISCELLANEOUS HAEMO-PARASITES.

(267) Seidelin (H.) & Connal (A.). **A Note upon the Occurrence of a Plasmodium in the Blood of West African Monkeys.**—*Ann. Trop. Med. & Parasit.* 1914. Apr. 21. Vol. 8. No. 1. pp. 81-82.

The authors have discovered parasites belonging to the genus Plasmodium in each of three young monkeys examined at the Medical Research Institute at Yaba, near Lagos. Two of the monkeys were *Papio sphinx*, and the other was a *Cercopithecus mona*. The parasites were very scantily present, but in two of them both gametocytes and schizonts were seen.

The following characters were observed: The pigment in fresh preparations was of a bright yellow colour, and in preparations stained with Giemsa it took on a brilliant green tint. The chromatin was looser in texture and stained more faintly than the chromatin in parasites of the human subject. The cytoplasm, and particularly that of the microgametocytes, stained very faintly.

Particular interest lies in the fact that only three monkeys were received and all were found to be infected.

(268) Sergent (Ed.) & Béguet (M.). **De l'Immunité dans le Paludisme des Oiseaux. Les pigeons guéris de l'Infection à *Haemoproteus columbae* ne sont pas immunisés contre elle.** [Immunity in Avian Malaria. Pigeons which have recovered from Infection with *Haemoproteus columbae* have not acquired Immunity against it.] —*Compt. Rend. Soc. Biol.* 1914. June 12. Vol. 77. No. 20. pp. 21-23.

The authors find that in those rare cases in which recovery takes place rapidly no degree of immunity is acquired; but in those more usual cases in which recovery is not complete, parasites remaining in the blood for long periods, this latent infection corresponds to a condition of relative immunity. In the event of complete recovery taking place this relative immunity is lost.

(269) Rowley-Lawson (Mary). **Free Malarial Parasites and the Effect of the Migration of the Parasites of Tertian Malarial Infections.**—*Jl. Exp. Med.* 1914. June. Vol. 19. No. 6. pp. 523-535. With 6 plates (one in colour).

"1. The malarial parasite is extracellular throughout its life-cycle and migrates from red corpuscle to red corpuscle destroying each before it abandons it; in the brief intervals between, the parasite is free in the blood serum; it does not remain long free, but almost immediately attaches itself to another red corpuscle by means of delicate pseudopodia.

"2. The compact form of the tertian parasite is the type of free parasite most often observed; in this form the parasite may be seen not only in migration, but after quinine and in the cadaver. I believe the compact form to be the normal resting form of the parasite, all other forms being assumed in order to secure attachment and to obtain food.

"3. Care must be taken not to confound free parasites having protoplasmic pseudopodia ready for attachment with the sexual flagellating parasites, whose flagella are composed of chromatin.

"4. The malarial parasite can live for some time free in the blood serum, though under normal conditions there is no reason why it should remain free for any length of time, and there are certain periods in the life of the parasite when it must be admitted that it is free from the corpuscle and survives. If the parasite is, as I believe, attached to the external surface of the red corpuscle, it is constantly exposed to the action of the patient's serum.

"5. The destruction of more than one red corpuscle by each parasite would readily account for the severe and early anaemia occurring in malarial infections."

"6. Long continued treatment with quinine will eventually cause the death of all malarial parasites."

(270) Rowley-Lawson (Mary). **A Stage in the Migration of the Adult Tertian Malarial Parasite. Evidence of the Extracellular Relation of the Parasite to the Red Corpuscle.**—*Jl. Exp. Med.* 1914. May. Vol. 19. No. 5. pp. 450-458. With 5 plates (one in colour.)

The author recapitulates her views regarding the extra-cellular position of the malarial parasite and its migrations from corpuscle to corpuscle, and in the present paper refers particularly to that stage in which pigmented parasites are found partly on and partly off degenerated red corpuscles, caught apparently in the act of leaving them.

"1. What appear to be certain definite stages in the migration of the malarial parasite from red corpuscle to red corpuscle may be demonstrated by thorough and persistent observations, not minutes spent on each specimen, but many hours.

"2. The migration of the malarial parasite from red corpuscle to red corpuscle gives a reasonable explanation of the loss of red corpuscles which cannot be accounted for by the destruction of the infected corpuscles at the time the parasites segment.

"3. Migration to other red corpuscles is a satisfactory explanation of the ultimate fate of the young parasites seen in instances of multiple infection of single corpuscles.

"4. In the light of the facts here presented, it would seem impossible to explain the instances of the parasites partly on and partly off degenerated red corpuscles as the result of technique. A stage in the migration of the parasite seems to me to be the probable interpretation of the phenomenon.

"5. A corpuscular mound encircled by an adult parasite, when seen at the periphery of the red corpuscle, should have the same significance and interpretation, in reference to the extracellular relation of the parasite to the corpuscle, that it has when it is seen in connection with a young parasite.

"6. The adult ring-form parasite should have the same interpretation as the young ring-form parasite.

"7. Attachment to the external surface of the red corpuscles seems to me to be the only possible interpretation of the appearances of the parasites pictured in this article."

(271) Fletcher (W.). **The Wassermann Reaction in Malaria.**—*Lancet.* 1914. June 13. pp. 1677-1678.

Conclusion: The presence of malarial parasites in the blood does not cause the serum to give a positive Wassermann reaction when the method of Browning, Cruikshank, and McKenzie is employed.

(272) Nawrotzky (N. N.). **Haematoparasitologische Notizen. Zweite Mitteilung.** [Notes on Blood Parasites. Second Part.]—*Centralbl. f. Bakt.* 1 Abt. Orig. 1914. Apr. 25. Vol. 73. No. 6. pp. 358-362. With 1 plate comprising 14 figures in colour.

This paper deals with the following parasites: The trypanosome of the pike, the trypanoplasma of the pike, a haemogregarine of the pike (new species), haemogregarine of the sterlet (new species), filaria of the white heron (new species), and the microfilaria of the rook.

(273) Ringenbach (J.). **Quelques Hematozoaires du Congo.** [Some Haematozoa from the Congo.]—*Bull. Soc. Path. Exot.* 1914. Apr. Vol. 7. No. 4. pp. 296-299.

The author has discovered a trypanosome in the blood of the

hornbill, *Bycanistes albotibialis*, commonly known as the Calao, which is possibly different from the parasites described by a number of other authors. But, as the authors point out, morphological differences are not always sufficient to establish a species.

The trypanosome had the following average measurements :—

Total length	53 microns.
Maximum width	8 „
Distance from the centrosome to the posterior extremity	5·7 „
Distance from the centrosome to the anterior edge of the nucleus	14·3 „
Larger diameter of the nucleus	4·2 „
Free portion of the flagellum	8 „

A microfilaria has been found in the blood of the same bird. The parasite was 234 microns in length by 3 in width. In the fresh state it was very actively motile. There was no sheath. The body tapered towards the posterior extremity, which was bluntly rounded. The parasite appears to be distinct from those described by LEGER as occurring in various hornbills in the Soudan. The author proposes the name *Microfilaria bycanisti*.

A microfilaria has also been found in the blood of the Touraco (*Schizorhis cristata*). In the fresh state this parasite moves very slowly. It is provided with an envelope which scarcely exceeds the parasite in length. The body measures 127 microns in length by 3·7 in width; the sheath is about three times the width (10 microns). The name *Microfilaria schizorhinos* is suggested, as the author is unable to say whether the parasite is identical with that which PLIMMER found, but did not describe, in two touracos in West Africa.

The author has found parasites resembling the microgametocytes of *Plasmodium kochi* in the blood of a *Cercopithecus cephus*.

TSETSE FLIES.

(274) LLOYD (Ll.). **Note on Scratching Birds and Tsetse-fly.**—*Ann. Trop. Med. & Parasit.* 1914. Apr. 21. Vol. 8. No. 1. p. 83.

The suggestion has been made from time to time that guinea-fowl might, among other birds, act as a control to Glossina by ingesting the pupae, and the value of this suggestion has been tested by the author by the examination of the contents of the crops of ten guinea-fowl at Nawalia in the Luangwa Valley.

The birds are very numerous in Northern Rhodesia and especially in the Luangwa Valley.

In only three were any insects found, and in these they were very scantily present. No pupae of any kind were recorded. It appears that the bird is a vegetable feeder, and only eats insects when searching for food. The pupae of *G. morsitans* are usually placed in positions that are inaccessible to these birds, and therefore the guinea-fowl cannot be considered as suitable to act as a control of the fly.

(275) Shircore (J. C.). **Suggestions for the Limitation and Destruction of** *Glossina morsitans.*—*Bull. Entom. Res.* 1914. Apr. Vol 5. No. 1. pp. 87-90. With 1 map.

The author's observation leads him to conclude that in the "proclaimed area" there are at least four "primary centres" which harbour tsetse flies.

These areas are defined as "primary centres" for the following reasons.—Flies are found abundantly in these centres throughout the year, even when there are none or very few elsewhere. These are the only areas in which during the dry season there is water above or at a slight depth below the surface of the earth. These situations offer the best chance of feeding for the flies during the drought, as they are frequented by various species of game. The conditions, viz., light forest with open glades, short grass and water close at hand, form an ideal combination for both game and fly.

The probability is that the flies breed in these areas and from them spread to the surrounding country when the conditions become favourable. This spreading has been observed, and it has also been observed that "secondary centres" are formed with the onset of the rains, a different type of country being then more suitable.

The author advises that the forest connections along which these radiations take place should be cut off or otherwise dealt with about May, so that the "primary centres," which should have been delimited at the height of the previous dry season, may be isolated. The trees in the areas should then be cut down and left to dry, extensive burning of the areas being practised when the drying is complete.

(276) Zupitza (M.). **Versuche und Vorschläge zur Verbesserung von Glossinenfangmethoden.** [Experiments and Suggestions for the Improvement of Methods for Catching Tsetse Flies.]—*Arch. f. Schiffs. u. Trop.-Hyg.* 1914. June. Vol. 18. No. 11. pp. 363-375. With 2 figures.

The author is of the opinion that the limed cloths used by Cleve fail in their object to a great extent because they do not allow the passage through them of the scent of the man or animal upon which they are placed. To avoid this objection he used sheets of wire gauze with a mesh of about 2 centimetres. He found, however, that this was too large a mesh, and therefore used two layers of the gauze, one over the other. The gauze was hung in front and behind after the manner of sandwich boards, and the straps were so constructed that the gauze could be taken off for the purpose of removing flies adherent to it.

The lime used smelt of resin, and had a honey-like consistence and colour. During the warm periods of the day it became very fluid and had to be renewed every two hours. It was easily soluble in spirit, but not in pure water.

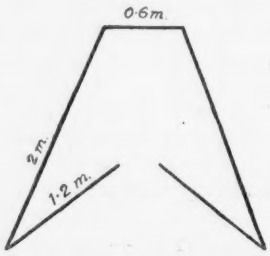
A comparison is made between the number of flies caught by means of this apparatus and the number caught during the same periods and at the same places with a net. This indicates that the butterfly net is slightly superior as a means of catching the flies.

Improvements are suggested in the manner of carrying the wire, mesh coverings. In order to completely cover the body it is suggested that a slightly flattened cylinder of the gauze would be the best. The gauze should be made of iron wire about 2 mm. thick, and should have a mesh of about 1 centimetre. Porous material of a rather dark colour should be worn underneath the gauze, and specially stout material should be used for covering the arms and legs.

The author also describes a fly trap with which no lime is used.

The trap consists of a cage, which in section is described as being shaped like an arrow-head with the point cut off. The depth of the trap from before to behind is about 2 metres. The side opposite that representing the truncated point of the arrow is composed of two doors opening inwards and leaving between them a narrow opening. The flycatcher is placed inside the trap. Flies coming in contact with the sides of the trap eventually find their way in and are caught. The trap itself consists of a framework covered with a thick muslin.

The diagram shows the plan of the trap with measurements.



(277) Simpson (J. J.). **Entomological Research in British West Africa. V. Gold Coast.**—*Bull. Entom. Res.* 1914. Apr. Vol. 5. No. 1. pp. 1-36. With 4 plates and 1 map.

This paper deals mainly with the distribution of various blood-sucking insects, but information is also given regarding the following points:—The position, configuration, and vegetation of the colony, climate and rainfall, insect-borne diseases in man and other animals, distribution of the genus Glossina, and parasites of mammals.

With regard to the diseases of animals, it is said that very few cattle are bred in the colony, but that 80 per cent. of the animals brought down from the north for slaughter at Coomassie are infected with trypanosomes. Only *T. cazalboui* and *T. pecaudi* have been found in cattle. Beal states that these two with *T. dimorphon* are equally prevalent in horses. *T. dimorphon* alone has been found in dogs. Two sheep out of 83 examined have been found infected with trypanosomes similar to those occurring in cattle. Only one case of trypanosomiasis has been observed in the goat, and none in the pig.

Two cases of spirochaetosis have been recorded in the sheep and one in the goat by O'Brien.

Blood smears from eleven different kinds of game were examined for parasites, but none were found.

HELMINTHS.

(278) Railliet (A.), Henry (A.) & Bauche (J.). **Sur les Amphistomiens des Ruminants domestiques de l'Annam.** [The Amphistomes of Domestic Ruminants in Annam.]—*Recueil Med. Vet.* 1914. May 30. Vol. 91. No. 10. pp. 195-201.

In cattle slaughtered at Hue amphistomes are found most frequently in the rumen, but they also occur in the reticulum, abomasum, and bile ducts. A number of different species have been found.

In the buffalo the following parasites have been found in the rumen : *Gastrothylax cobboldi*, *G. elongatus*, *G. minutus*, *Paramphistomum orthocoelium*, and *P. papillosum*. In the ox, *Gastrothylax crumenifer* has been found.

G. elongatus has been found in the reticulum of the buffalo only.

Paramphistomum bathycotyle, *Cotylophoron cotylophorum*, and *Homalogaster paloniae* have been found in the abomasum of the buffalo, ox and sheep respectively.

Paramphistomum explanatum has been found in the bile ducts of the buffalo.

The authors think that *Paramphistomum fraternum*, Stiles and Goldberger, 1910, is synonymous with *P. explanatum*.

They are further of the opinoin that *H. poirieri*, Giard and Billet, 1892, and *H. philippinensis*, Stiles and Goldberger, 1908, are in reality identical with *H. paloniae*.

The question of the pathogenic rôle played by amphistomes is considered, and the authors state that by means of the phenolthalein test they have been able to detect the presence of blood in the bodies of *G. elongatus* and *crumenifer*, and have obtained doubtful results with *G. cobboldi* and *minutus*. Some evidence has been obtained that the ventral pouch of the parasites contains sanguinolent liquid. The question as to how this liquid gains access to the pouch is interesting, because it is known that neither the mouth nor the orifice of the ventral pouch is provided with an armature for penetrating the mucous membrane, nor has any lesion of the mucous membrane ever been described. The suggestion is made that the examination of parasites *in situ* in animals freshly slaughtered also throws some light upon the question of the nutrition of the parasites.

(279) Seurat (L. G.). **Sur un Nématode parasite du Flammant rose.** [A Nematode Parasite of the red Flamingo.]—*Compt. Rend. Soc. Biol.* 1914. May 22. Vol. 76. No. 17. pp. 814–817. With 4 text figs.

Fifteen specimens of a female Tropidocerca were found by the author in the gastric glands of two flamingoes killed in Algeria. Owing to the bright red colour, the name *Tropidocerca coccinea* is suggested.

Female.—Practically the whole of the body consists of a red globular structure measuring about 2·5 millimetres in diameter. Laterally, dorsally, and ventrally there are longitudinal bands of muscle fibres. These longitudinal bands are connected by circular strands which produce an appearance of transverse striation.

This globular portion of the body in reality represents only the middle part, greatly distended owing to the exaggerated development of the intestine and uterus. Anteriorly the body is continued in the

form of a pointed projection comprising the oesophageal and cephalic portions. Posteriorly there is a conical tail, and the anus is situated a little in front of the extremity.

The buccal cavity is rounded and measures about 20 microns. The oesophagus is encircled at its middle point by the nerve ring. The muscular portion of the oesophagus measures about 350 microns, and the glandular portion about 1·5 mm. The cephalic portion shews two lateral papillae anterior to the nerve ring; these are not exactly opposite each other. The ventral excretory pore opens very close behind the posterior border of the nerve ring.

The vulva is situated about 0·5 mm. in front of the anus. The vestibule and sphincter of the ovijector are very short. The vestibule is thickened in the distal portion, and contains nucleated muscle cells. It is lined by tall epithelial cells, which come into contact with each other at the free surface, leaving no visible lumen.

The uteri are very narrow, and are lined with large flat epithelial cells. They run parallel with each other and follow a very sinuous course. Numerous eggs are contained in them and the initial part of each is connected with the oviducts by a seminal receptacle of enormous size. The oviduct which leads from it is very narrow. The oviducts and the ovaries may be as much as 8 mm. in length.

The eggs have a thick smooth envelope, and the larvae at the time of hatching measure about 30 microns by 15. They collect in the uterus and pass through the ovijector without stopping there. About 50 may be found in each of the paired branches of the uterus.

The male is unknown.

MISCELLANEOUS.

(280) Watson (E. A.). **Preliminary Studies and Experiments with Swamp Fever.**—*Dept. of Agriculture, Canada. Report of the Veterinary Director General* (F. Torrance, B.A., D.V.S.) *for the Year ending* 31*st Mar.*, 1913. Ottawa: Printed by C. H. Parmalee. pp. 86-87.

The author's experience regarding the virulence of swamp fever blood when inoculated in series in horses agrees with that of Van Es and others in that there is a progressive loss. A sample of blood obtained from a natural case in the Onoway District, Alberta, produced an acute attack at the first and second passages, but subsequently only chronic forms of the disease, which terminated in recovery. In these animals clinical symptoms were practically absent.

It is suggested that this is an indication that under natural circumstances the disease is insect borne, the insect cycle being necessary for the retention of the full degree of virulence.

It has been found that swamp fever blood does not react to the serum tests used for trypanosome diseases, but that the globulin content of the blood is markedly increased.

(281) Panisset (W. L.). **Paralysie bulbaire Infectieuse. Pseudo-Rage, Maladie d'Aujeszky.** (Infectious Bulbar Paralysis. False Rabies, Aujeszky's disease.)—*Rev. Gen. Med. Vet.* 1914. June 1. Vol. 23. No. 275. pp. 601-618. With 4 text figs.

This article contains no new information regarding the disease, but summarises our knowledge of the condition.

(282) Jonesco-Michaïesti (C.) & Combiesco (D.). **Sur une Epidemie de Dysenterie Bacillaire chez des Singes inférieurs.** [An Epidemic of Bacillary Dysentery in the Lower Monkeys.]—*Compt. Rend. Soc. Biol.* 1914. May 22. Vol. 76. No. 17. pp. 827-829.

The outbreak described by the authors occurred among a number of *Macacus rhesus* kept for experimental purposes. The clinical features and the lesions presented no remarkable features.

The organism isolated on Conradi-Drigalski and in bile broth resembled the Flexner type of bacillus.

Only two sera were available for agglutination tests: a polyvalent serum prepared with the bacilli of Shiga, Flexner, Dopter, Duval, and Y, and a serum agglutinating only the Shiga type. The Shiga serum agglutinated the bacillus isolated in dilutions of 1 in 80 only. The polyvalent serum agglutinated the Flexner and Y types in dilutions of 1 in 300, and the Strong type and the bacillus isolated in 1 in 150.

The authors conclude that:

With regard to the majority of the cultural characters, the bacillus isolated belongs to a type of dysentery bacillus allied to Flexner's bacillus, while as regards agglutination it approaches more closely the bacillus of Strong.

(283) Landois (F.) & Hoepke (H.). **Eine endoparasitäre Milbe in der Lunge von *Macacus rhesus*.** [An Endoparasitic Acarus in the Lungs of *Macacus rhesus*.]—*Centralbl. f. Bakt.* 1. Abt. Orig. 1914. Apr. 25. Vol. 73. No. 6. pp. 384-395. With 1 plate and 3 text figs.

After summarising the recorded cases of endoparasitic acariasis the authors describe one occurring in the monkey.

The animal in which the lesions were found was one that was being used in a bone-transplantation operation at Breslau.

In each lung there were found eight to ten round nodules lying close under the pleura. They were not connected with a bronchus. In colour they varied from greyish-yellow to pale yellow, and on section shewed small, dry-looking centres about the size of lentils. The larger ones had crumbling material in the centre in which the acari could be detected with the microscope.

Histological examination shewed that the smallest nodules were composed of rounded and spindle-shaped cells, with a few leucocytes. At places there were collections of amorphous pigment granules of a reddish-brown colour. Tests of this pigment with potassium ferrocyanide gave negative results. The acari were found in the granular centres of the larger nodules, but none was found in the small nodules.

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Material containing a single acarus was injected into the thoracic cavity of another monkey. Six months later this animal died and a single acarus was found in a nodule at the hilus of the left lung.

A detailed description of the parasite is given and the name *Pneumotuber macaci* is suggested for it.

(284) Bouquet (A.) & Nègre (L.). **Sur la Nature mycosique du Parasite de la Lymphangite epizootique. Formation de Gouttelettes d'Huile et de Filaments.** [The Mycotic Nature of the Parasite of Epizootic Lymphangitis. The Formation of Droplets of Oil and of Filaments.]—*Bull. Soc. Path. Exot.* 1914. June. Vol. 7. No. 6. pp. 464-466. With 10 text figs.

The authors bring forward the following evidence in support of their view regarding the blastomycotic nature of the Cryptococcus of Rivolta :—

In specimens prepared from tubes of agar medium which have been thickly sown with pus, incubated at 24°C. for a week, and then kept at room temperature for two months, the following vegetative forms have been observed :

In addition to the ordinary budding forms of the parasite there are certain organisms which have attained a size of twice the normal. These are found to contain refractile droplets or fine granulations. At the narrower pole of such parasites there is a cylindrical outgrowth which is granular and measures 2 microns in diameter. The longest outgrowth seen measured 18 microns and was divided by a septum into two equal parts. Similar large forms without any outgrowths may be found in the water of condensation and in milk inoculated with pus.

The refractile granules are spherical and at first small, but they may run together and form a large droplet nearly filling the cryptococcus. The oily nature of these droplets has been ascertained by staining with osmic acid.

(285) Balfour (A.). **The Wild Monkey as a Reservoir for the Virus of Yellow Fever.**—*Lancet.* 1914. Apr. 25. pp. 1176-1178.

Attention was directed to this subject on account of a negro belief in Trinidad that an outbreak of yellow fever can be foretold because large numbers of red howler monkeys are always found dead before such an outbreak occurs, and certain information obtained suggests that there is possibly some connection between the deaths among the monkeys and the occurrence of yellow fever in man. It is suggested that workers in other parts of the world should investigate the subject.

(In the correspondence columns of the *Lancet* for May 9, 1914, Low writes to the effect that monkeys can but rarely if ever be reservoirs for the yellow fever virus, and brings forward evidence of his own to support this view.)

(286) Giemsa (G.). **Zur Schnellfärbung (Romanowsky-Färbung) von Trockenausstrichen.** [The Rapid Staining (Romanowsky Staining) of Dried Films.]—*Centralbl. f. Bakt.* 1. Abt. Orig. 1914. May. Vol. 73. No. 7. pp. 493-496. With 1 text fig.

In order to avoid certain defects in the method of rapid Giemsa staining published in 1910 the author has devised a new mixture which has the following composition :—

Azur II.-Eosin	3 gm.
Azur II.	0.3 „
Glycerine	25 „
Methyl alcohol	475 „

The solution is prepared warm, allowed to cool, and, after standing, is filtered. The solution is supplied under the name "*Farbfixierlösung nach G.*"

Slides having very thin films upon them are laid with the film side uppermost in special staining troughs which have ridges running across the bottom for the support of the slides.

The fixing and staining solution is dropped on to the slide from a drop-bottle until the whole of the film is covered, care being taken that the slide is absolutely horizontal. The trough is covered with a lid and left for half a minute, and in no case more than one minute.

In a wide measuring cylinder a mixture of 10 cc. of distilled water and 10 drops of the staining and fixing solution (*Farbfixierlösung*), or 10 drops of the original Giemsa solution, is prepared and this is poured into the trough so as to completely cover the slide. Gentle rocking completes the mixing of the solutions. The stain is then allowed to act for 10 minutes.

The specimen is washed in water, mopped, dried and mounted in liquid paraffin or in balsam that is free from acid.

This method differs from previous ones not only in the composition of this stain, but in the use of a staining mixture instead of water after the primary action of the staining and fixing fluid is completed. The object of this is to avoid the extraction of the stain from the specimen which occurs when water is used.

In the case of thick preparations they should be placed in distilled water or salt solution for a minute and again dried before staining, because this tends to dissolve the serous portion of the film which otherwise may become stained. Spirochaetes are said to be rendered especially distinct by this method.

The method is not so good for moist fixed preparations and for sections as the old method.

RECENT LITERATURE.

[Continued from this *Bulletin* Vol. 2, No. 2, pp. 110-112.]

Babesiasis (Piroplasmosis).

(287) MISSON (L.) Immunisation Artificielle contre la Piroplasmose du Bétail Européen importé au Brésil. [The Artificial Immunisation of Cattle imported into Brazil from Europe against Piroplasmosis.]—*Folia Microbiologica*, 1914. June 27. Vol. 3. No. 1, pp. 49–75. With 3 plates.

Foot and Mouth Disease.

(288) FAVERO (F.). Su la presenza di una sensibilizzatrice antiaftosa. [The Presence of a Sensitiser in Foot and Mouth Disease.]—*La Clinica Veterinaria*, 1914. Apr. 15–30. Vol. 37. No. 7–8, pp. 327–331.

(289) KALLERT (E.). Untersuchungen über Maul- und Klauenseuche. I. Mitteilung. Ueber die Bedeutung der v. Beteghschen Körperchen in der Aphthenlymphe. [Investigations into Foot and Mouth Disease. 1st Part. Significance of the von Betegh Bodies in the Lymph of the Aphthae.]—*Arbeit. a. d. Kaiserl. Gesundsheitsamte*, 1914. June. Vol. 47. No. 4, pp. 591–602. With 2 plates.

(290) KALLERT (E.). Untersuchungen über Maul- und Klauenseuche. II. Mitteilung. Beiträge zur Histogenese und Histologie der Maul- und Klauenseucheblase, inbesondere auch zur Frage des Vorkommens von Einschlusskörperchen in den spezifisch veränderten Teilen bei Maul- und Klauenseuche.—[Investigations into Foot and Mouth Disease. 2nd Part. Histogenesis and Histology of the vesicles in Foot and Mouth Disease, especially in regard to the Occurrence of Inclusion Bodies in the specifically changed Parts.]—*Arbeit. a. d. Kaiserl. Gesundsheitsamte*, 1914. June. Vol. 47 No 4, pp. 603–613. With 2 plates.

(291) WEHRLE (E.) & KALLERT (E.). Versuche mit "Trypasafrol" und "Novotrypasafrol" sowie mit "Ernanin" bei Maul- und Klauenseuche. [Experiments with "Trypasafrol," "Novotrypasafrol," and "Ernanin" in Foot and Mouth Disease.]—*Berl. Tierärtz. Wochenschr.*, 1914. April 9. Vol. 30. No. 15, pp. 253–257.

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(292) CARINI (A.). L'Emétique dans le Traitement de la Leishmaniose cutanée et muqueuse. [Emetic in the Treatment of Leishmaniasis of the Skin and Mucous Membranes.]—*Bull. Soc. Path. Exot.*, 1914. April. Vol. 7. No. 4, pp. 277–281.

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(293) PITSCHUGIN (P. I.). Kultivierungsversuche mit *Plasmodium vivax* nach der Methode von Bass. [Cultivation Experiments with *Plasmodium vivax* according to Bass's Method.]—*Centralbl. f. Bakt.*, 1. Abt. Orig., 1914. Apr. 25. Vol. 73. No. 6, pp. 373–384.

(294) STEPHENS (J. W. W.). A New Malaria Parasite of Man.—*Proc. Roy. Soc.*, 1914. April 8. Vol. B. 87. No. B 596, pp. 375–377. With 3 plates.

(295) THOMSON (D.). The Origin and Development of Gametes (Crescents) in Malignant Tertian Malaria; some Observations on Flagellation, etc. (Being Part II of the Reports on the Malarial Expedition to Panama, 1912.)—*Ann. Trop. Med. and Parasit.*, 1914. Apr. 21. Vol. 8. No. 1, pp. 85-104. With one coloured plate.

Rabies, False.

(296) SANGIORGI (Giuseppe). La Filtrabilità del Virus della Pseudorabbia.—*Giorn. R. Accad. Med. di Torino*, 1914. Mar.-Apr. Vol. 77. No. 3–4, pp. 69–78.

(297) SANGIORGI (Giuseppe). Ricerche sulla Pseudorabbia.—*Pathologica*, 1914. June 1. Vol. 6. No. 134, pp. 282–284.

Trypanosomiasis.

(298) CARINI (A.) & BOTELHO, jnr. (C.). Sur quelques Trypanosomes d'Oiseaux du Brésil. [Some Bird Trypanosomes of Brazil.]—*Bull. Soc. Path. Exot.*, 1914. May. Vol. 7. No. 5, pp. 395–398. With 3 text figures.

(299) CARINI (A.) & MACIEL (J.). Existence de la Maladie de Chagas dans l'État de Sâo Paulo. [The Existence of Chagas disease in Sao Paulo (Brazil).]—*Bull. Soc. Path. Exot.*, 1914. Apr. Vol. 7. No. 4, pp. 289–292.

(300) LEGER (A.) & LEGER (M.). Trypanosomes et Haemoproteus d'Oiseaux du Haut-Sénégal et Niger. [Trypanosomes and Haemoproteus of Birds of Upper Senegal and Niger.]—*Bull. Soc. Path. Exot.*, 1914. June. Vol. 7. No. 6, pp. 493–497. With two tables.

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(301) AUSTEN (E. E.). A Dipterous Parasite of *Glossina morsitans*.—*Bull. Entomol. Research*, 1914. Apr. Vol. 5. No. 1, pp. 91–93. With 1 text figure.

(302) FROGGATT (W. W.). Sheep-Maggot Flies in Australia. *Bull. Entomol. Research*, 1914. Apr. Vol. 5. No. 1, pp. 37–39.

(303) LLOYD (Ll.). Further notes on the Bionomics of *Glossina morsitans* in Northern Rhodesia.—*Bull. Entomol. Research*, 1914. Apr. Vol. 5. No. 1, pp. 49–60. With 4 plates and 1 map.

(304) NEWSTEAD (R.) and DAVEY (J. B.). First Preliminary Report on the Bionomics of *Glossina morsitans*.—*Reports of the Sleeping Sickness Commission of the Royal Society*. 1914. No. 15, pp. 142–157. With 3 plates.

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(305) JOHNSTON (T. H.). Second Report on the Cestoda and Acanthocephala collected in Queensland.—*Ann. Trop. Med. & Parasit.*, 1914. Apr. 21. Vol. 8. No. 1, pp. 105–112. With 1 plate.

(306) NICOLL (W.). The Trematode Parasites of North Queensland. II. Parasites of Birds.—*Parasitology*, 1914. June. Vol. 7. No. 2, pp. 105–126. With 2 plates comprising 13 figures.

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(308) LEGER (M.) & LEGER (A.). Hématozoaires des Reptiles du Haut-Sénégal-Niger. [Haematozoa of Reptiles in Upper Sénegal and Niger.]—*Bull. Soc. Path. Exot.*, 1914. June. Vol. 7. No. 6, pp. 488–493. With 6 text figures.

(309) MINE (N.). Beiträge zur Kenntnis der Blutparasiten der Vögel in Japan. [The Blood Parasites of Birds in Japan.]—*Arch. f. Protistenkunde*, 1914. May 14. Vol. 34. No. 2, pp. 198–211. With 2 plates in colour comprising 109 figures.

(310) MOLDOVAN (J.). Untersuchungen über den Zeugungskreis des *Leucocytozoon ziemanni* (Laveran). [Investigations regarding the Developmental Cycle of *Leucocytozoon ziemanni*.]—*Arch. f. Protistenkunde*, 1914. June 17. Vol. 34. No. 3, pp. 249–262. With 2 plates.

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(315) GROSSO (G.). Pathologisch-anatomische Veränderungen des Darmes und der Lunge des Affen (Macacus) durch tierische Parasiten verursacht. [Lesions in the Intestine and Lungs of the Monkey caused by Animal Parasites.]—*Zeitschr. f. Infektionskrankh. parasit. Krankh. u. Hyg. d. Haust.*, 1914. May 8. Vol. 15. Nos. 3–4, pp. 261–267. With 2 plates comprising 7 figures and 4 text-figures.

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